PAGE'S WEEKLY.—February 3, 1905. Thin Paper Copy for Circulation Abroad.

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PAGE'S WEEKLY

ENGINEERING · ELECTRICITY SHIPBUILDING MINING IRON & STEEL INDUSTRIES

EDITORIAL & PUBLISHING OFFICES, CLUN HOUSE, SURREY STREET, STRAND, LONDON, W.C.

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PAGE'S WEEKLY

Miscellaneous

Mr. G. H. HUGHES, M.I.Mech.E.,

Consulting and Organising Engineer for Water Works and Industrial Undertakings,

97, QUEEN VICTORIA ST., LONDON, E.C.

Telephone No.: 5754 Bank. Write for particulars.

ED. BRAND,

MECHANICAL ENGINEER,
35, SHAKESPEARE STREET, MANCHESTER.

Modern Wire-Working Machinery,

Such as for Rolling, Drawing, Weaving, Netting, Forming, Automatic Straightening and Cutting, Cabling, Testing, &c.

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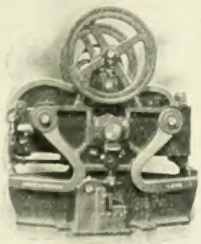
PATENT WATER-TUBE BOILERS.

These Boilers are in use throughout the world to the extent of 4,700,000 h.p., generating steam for all purposes, and fired with all kinds of fuel.

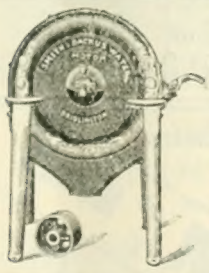
See our Advertisement appearing February 17th, page 45.

HEAD OFFICES—Oriel House, Farringdon Street, LONDON, E.C.
WORKS—Renfrew, SCOTLAND.



PUNCHING & SHEARING Machines.
STEAM HAMMERS.
Shipbuilders' MACHINE TOOLS.

DAVIS & PRIMROSE,
Leith Ironworks, EDINBURGH.



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SMITH'S

Backus Water Motors

1/16 to 10 H.P.

Will drive any class of Machinery, and work on 15 lb. pressure.

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Chartered Patent Agents.

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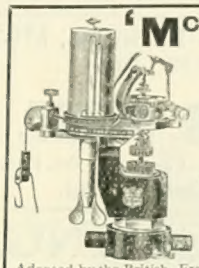

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Special Indicators for Gas, Winding, and Ammonia Engines, and for Motor-Cars.

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MANUFACTURERS OF . . .

Rolled Steel Joists, Channels, etc.

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Speciality: TRAMRAILS.

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BOILERS

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VERTICAL STEAM BOILERS

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"UNICA" SILENT GEARS

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NO SIDE PLATES OR BUSHES! UNAFFECTED BY OIL!

Have stood test of four years.

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RECORDERS.

For further particulars . . of our . . see our whole page Ad. on Feb. 17th.

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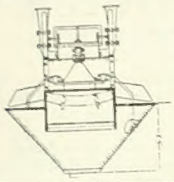
PAGE'S WEEKLY — Miscellaneous

Bogie Locomotives for Short Curves. A large number of these Engines have been built to NARROW and to NORMAL GAUGE.—For full particulars, and for Licences, &c., address the HAGAN'S LOCOMOTIVE WORKS, ERFURT, GERMANY.

Melville and Macalpine, Consulting Engineers and NAVAL ARCHITECTS, 615, WALNUT STREET, PHILADELPHIA, PA., U.S.A.
Rear-Admiral GEORGE W. MELVILLE, Ex-Engineer-in-Chief of the United States Navy, and JOHN H. MACALPINE, having a very extensive acquaintance in the best engineering circles in the United States, Britain, and the Continent of Europe, especially SOLICIT INTERNATIONAL BUSINESS.



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COVENTRY, ENG.
Speciality—
FORGING PLANT.
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Write for Section Lists and Prices.
Telegrams: "LEGATION, LEEDS."

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Blue Planished and Glazed Steel Sheets for Lagging and Covering generally.
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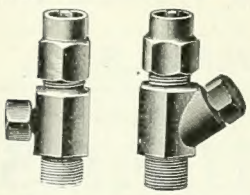
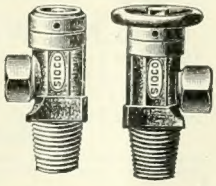
Situated on Pascagoula Bay and on the line of the Louisville and Nashville Railroad. These works have been in operation for more than twenty-six years. ORDERS for Creosoted Piles, Telegraph Poles, Cross Arms, Electric Conduits, Paving Blocks, Sawed Tiles, and Timber PROMPTLY EXECUTED. New cylinders, 115 ft. long. Capacity, one million feet per month. A.B.C. Code used. Cable address: Pierre, West Pascagoula, Miss.—Address, JNO. B. LINDSEY, Superintendent.

SHONE PNEUMATIC EJECTORS
FOR RAISING SEWAGE, SLUDGE, WATER, &c.
Air Compressing Machinery
FOR ALL SERVICES.
HUGHES & LANCASTER
47, VICTORIA STREET, LONDON, S.W.



The
Scotch & Irish Oxygen Co., Ltd.,
ROSEHILL WORKS, GLASGOW.
Valves for Gas Bottles, Refrigerating Plant, etc., in Bronze, Steel, and Aluminium.
Reducing Valves, Keys, and all Fittings for Compressed Gases.



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Head Office and Works, **LEEDS.**
Makers and Erectors of all Classes of
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A BUSINESS FOR YOU or YOUR SON.
Chips and Saw-dust FIRELIGHTERS.
GLOVER'S PATENT MACHINERY
ENORMOUS Saves 12 to 80 Men's Work. PROFITS
M. GLOVER & CO., Saw Mill Engineers, LEEDS.

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See our Advertisement appearing February 17th.
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Telephone: 365 London Wall. Telegrams: "Transumo."

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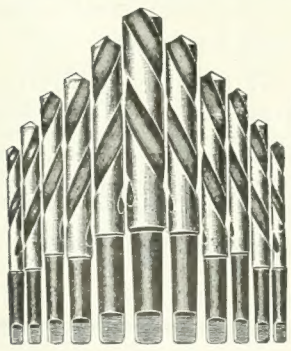
STOCKTON-ON-TEES,
for all kinds of
COLLIERY PLANT & MINING MACHINERY.



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NEW "STANDARD" MACHINES.
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Dynamos "P.D.M." Motors
BEST MATERIAL, WORKMANSHIP AND DESIGN.
PHŒNIX DYNAMO MFG. CO., Ltd.,
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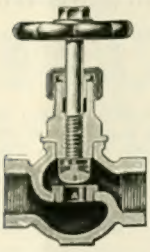
PAGE'S WEEKLY — Miscellaneous

The "SHAW" Patent Steam Valves . .



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The "SHAW" Patent Parallel Slide Valve is the Acme of Simplicity and Durability.

Try Them! Sent on Approval.

Write for particulars of these and other Specialities for High Pressure Steam.

JOSEPH SHAW, B Dept., Albert Works, HUDDERSFIELD.

Contractors to H.M. Government.

BRADBURY & CO., LTD.

Capstan Lathes and Labour Saving Tools.

WELLINGTON WORKS, OLDHAM.

Lists Free.

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IS EXTENSIVELY UNDERTAKEN BY

MESSRS. ELLIOTT & FRY

in any part of the United Kingdom, for which work special terms will be sent on application, distance being no object.

ONLY ADDRESS:—

55, Baker Street, LONDON, W.

Telegrams: PHOTICS, LONDON. Telephone: 293 PADDINGTON.

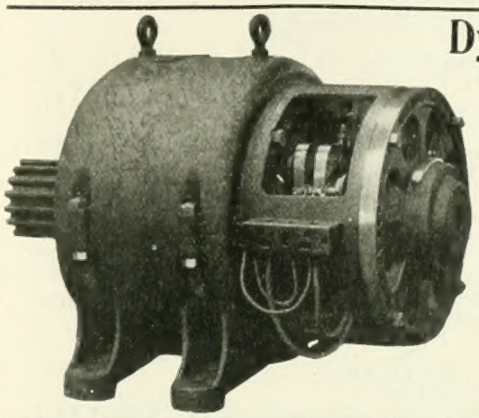
Refuse Destructors.

Write for particulars to:—

HEENAN & FROUDE, LIMITED,

4, Chapel Walks, MANCHESTER.

Works: MANCHESTER and WORCESTER.



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for all purposes.

NEWTON BROS., DERBY.

HIGH-CLASS

NEW MACHINE TOOLS

IN STOCK FOR IMMEDIATE DELIVERY.

THOS. W. WARD, LIMITED,

Send for Catalogue (post free).

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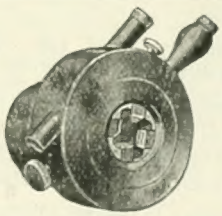


HARTNESS AUTOMATIC OPENING DIE

The most satisfactory means yet devised for the production of screw threads.

JONES & LAMSON MACHINE CO.,

JUBILEE BUILDINGS,

97, Queen Victoria Street, LONDON.

PAGE'S WEEKLY

Contracts

CONTRACTS.

EAST INDIAN RAILWAY. — The East Indian Railway Company is prepared to receive TENDERS for the SUPPLY and DELIVERY of—

(1) HEMATITE PIG IRON;
(2) MATERIALS for STEEL FOUNDRY (Ferro-manganese, ferro-silicon, ground ganister, silica sand, &c.);
(3) BRASS BOILER TUBES;
(4) STEEL PALISADE FENCING for PLATFORMS;
(5) MISCELLANEOUS TOOLS and STORES;

as per specifications to be seen at the Company's Offices.

Tenders are to be sent to the undersigned not later than Twelve o'clock noon, marked "Tender for Pig Iron," or as the case may be, for Nos. 1 to 4, on Wednesday, the 8th day of February proximo, and for No. 5, on Wednesday, the 15th day of February proximo.

The Company reserves to itself the right to divide the order, also to decline any Tender without assigning a reason, and does not bind itself to accept the lowest or any Tender.

For each specification a fee of One Guinea is charged, which cannot under any circumstances be returned.

By order,
C. W. YOUNG, Secretary.

Nicholas Lane, London, E.C.
January 26th, 1905.

THE SOUTHERN MAHRATTA RAILWAY COMPANY, LIMITED.

The Board of Directors of the Southern Mahratta Railway Company, Limited, are prepared to receive TENDERS for :—

1. SAFETY SIDE CHAINS.
2. SPIRAL SPRINGS FOR SAFETY CHAINS,

as per specifications and drawing, which may be seen and copied at the offices of the Company. The charge for each specification is One Guinea, which will not be returned.

Tenders must be sent in, addressed to the Secretary, marked "Tender for Safety Chains," or as the case may be, not later than Twelve o'clock noon on Tuesday, the 7th February, 1905.

The Directors do not bind themselves to accept the lowest or any Tender.

By order of the Board,
EDW. Z. THORNTON,
Secretary.

46, Queen Anne's Gate, S.W.,
January 25th, 1905.

GREAT WESTERN AND MIDLAND RAILWAYS JOINT COMMITTEE.

The Great Western and Midland Railways Joint Committee is prepared to receive TENDERS for the ERECTION of a STEEL FOOTBRIDGE at Oldminster, near Sharpness.

Plans and Specifications may be seen, and forms of Tender and bills of quantities obtained, at the Office of the Engineer, at the Paddington (Great Western Railway) Station, London, on and after Monday, the 23rd instant, between the hours of 10 a.m. and 4 p.m.

Tenders, addressed to the undersigned, and marked outside "Tender for Oldminster Footbridge," will be received on or before Monday, the 6th February.

The Directors do not bind themselves to accept the lowest or any Tender.

W. CLOWER,
Secretary.

Derby Station,
January 19th 1905.

COUNTY BOROUGH OF WEST HAM.
TENDERS FOR SUPPLIES, &c.

The Council hereby invite Tenders for the supply of Engine-Room Stores, Cable, Integrating Wattmeters, Double-Pole House Cut-Out Boxes, Transformers, Incandescent Lamps, Coal.

Forms of Tender and further particulars may be obtained after the 26th inst., at the Borough Electrical Engineer's Office, Central Electricity Station, Tucker Street, Canning Town, upon the payment of £1 for each form of Tender, which will be returned upon receipt of a *bonâ fide* Tender.

Tenders to be enclosed in endorsed envelopes supplied with the forms, and sent to my office not later than 4 o'clock on Thursday, February 9th, 1905.

The Tenders will be opened at the Town Hall, West Ham, on Friday, February 10th, 1905, at 3 p.m., and persons tendering may be present if they so desire, but no guarantee is given that any information, beyond the names of persons tendering, will be read out.

The Council do not bind themselves to accept the lowest or any tender. The contractor will be required to enter into a bond with sureties for the due performance of the contract, and no goods, materials, &c., will be ordered under any contract until such bond has been duly executed.

The contractor whose Tender is accepted, and with whom a contract is entered into, will be required to pay to the whole of his workmen such rates of wages, and observe such hours of labour, as are recognised by the workmen's trade unions, and in force at the time of signing the contract. In the event of any breach of such agreement the Council will enforce the penalty clause in its entirety.

By order of the Council
FRED E. HILLEARY,
Town Clerk.

Town Hall, West Ham, E.
January 21st, 1905.

BURY AND DISTRICT WATERWORKS.
TO CONTRACTORS.
PIPE LINE FROM GIN HALL RESERVOIR TO WHITEFIELD, CONTRACT No 2.

The BURY and DISTRICT JOINT WATER BOARD invite TENDERS for CUTTING and REFILLING TRACK and LAYING and JOINTING 10,500 lineal yards of 12-in. diameter CAST-IRON from Gin Hall Reservoir, near Bury, to Whitefield, and other relative works.

Plans may be seen and copies of the Specification and Bill of Quantities and Form of Tender obtained at the Bury Office of the Engineer to the Board, Mr. J. CARTWIGHT, Civil Engineer, Peel Chambers, Bury, on and after the 20th instant, upon payment of £1. This sum of deposit will, after the Board shall have come to a decision upon the Tenders, but not before, be returned to the Tenderers, provided they shall have sent in a *bonâ fide* Tender and shall not have withdrawn the same, and shall have returned all documents furnished to them for the purpose of making up their Tender.

Tenders, enclosed in the official envelopes provided, must be delivered at the Office of the Subscriber not later than Saturday, the 18th February next.

JOHN HASLAM,
Clerk to the Board.

Bank Street, Bury,
January 16th, 1905.

ILFORD URBAN DISTRICT COUNCIL.

The Council are prepared to receive TENDERS for the supply of about

2,400 YARDS 4-INCH CONCENTRIC ARMOURED CABLE.

Copies of the Specification, conditions, and form of Tender may be obtained on application to Mr. ARTHUR H. SHAW, Electrical Engineer to the Council, Electricity Works, Ley Street, Ilford.

Tenders addressed to the Chairman of the Council, Town Hall, Ilford, and endorsed "Tender for Cable," must be delivered on or before Tuesday, February 7th, 1905, at 4 p.m.

The Council do not bind themselves to accept the lowest or any Tender.

JOHN W. BENTON,
Clerk to the Council.

Town Hall, Ilford, January 25th, 1905.

COUNTY BOROUGH OF BURY.
ELECTRICITY WORKS EXTENSION.

The Electricity Committee is prepared to receive TENDERS for the Supply and Erection of the following Plant :—

ONE 500kw DIRECT-CURRENT HIGH-SPEED GENERATING SET.

Copy of Specification and Form of Tender may be obtained from Mr. S. J. WATSON, M.I.E.E., Engineer and Manager, Electricity Works, Bury, on payment of a deposit of Two Guineas, which will be returned on receipt of a *bonâ fide* Tender.

Sealed Tenders, endorsed "Tender for Generating Plant," and addressed to the undersigned, must be delivered at the Municipal Offices, Bank Street, Bury, not later than noon on Tuesday, February 14th, 1905.

JOHN HASLAM,
Town Clerk.

Municipal Offices, Bury,
January 23rd, 1905.

WIDNES CORPORATION WATER-WORKS.
TO BORING AND WELL-SINKING CONTRACTORS.

The Widnes Corporation invite TENDERS for SINKING TWO 32-in. BOREHOLES in the new red sandstone at their Stocks Well Pumping Station.

Copies of Specification and Plans may be had on application to the Engineer, Mr. ISAAC CARR, M.Inst.C.E., Widnes, on payment of Three Guineas, which will be returned on receipt of a *bonâ fide* Tender.

Tenders, endorsed "Boring," must be addressed to the Chairman of the Gas and Water Committee, and delivered at the Town Hall, Widnes, on or before noon on Tuesday, February 7th, 1905.

By order,
H. S. OPPENHEIM,
Town Clerk.

Widnes, January 16th, 1905.

BOARD OF PUBLIC WORKS.—NOTICE TO CONTRACTORS.

Sealed TENDERS, addressed to the undersigned, will be received up to, but not later than, Ten o'clock a.m. on the 11th day of February, 1905, for EXECUTING certain WORKS at Downies Bay, County Donegal, viz. : An EXTENSION of the existing PIER, DREDGING, ROCK EXCAVATION, &c., according to the plans to be seen at the Coastguard Station, Mulroy, Larganreagh, Letterkenny, County Donegal, and at this Office, where the specification, schedule, form of contract, and printed form of Tender can be had.

The Board will not be bound to accept the lowest or any Tender.

By order,
H. WILLIAMS,
Secretary

Office of Public Works, Dublin
December 22nd 1904.

PAGE'S WEEKLY

Contracts

METROPOLITAN BOROUGH OF BERMONDSEY.
ELECTRICITY AND DESTRUCTOR WORKS.

The Council of the above Borough is prepared to receive TENDERS for the SUPPLY of the undermentioned Articles for one year from March 31st, 1905 :—

ARC LAMP CARBONS.
CONDUITS.
ELECTRICITY METERS, DEMAND INDICATORS and MAIN FUSES.
ENGINE OILS.
INDIARUBBER CABLES and JOINTING MATERIAL.
LEAD-COVERED CABLES.
METER BOARDS.

The person whose Tender may be accepted will be required to enter into a contract for the due performance of the works.

Samples may be seen at the Electricity Works upon application to Mr. VINCENT, the Borough Electrical Engineer.

Canvassing either personally or by letter will disqualify any party tendering. The Council does not bind itself to accept the lowest or any Tender.

Forms of Tender and other particulars can be obtained on application to the undersigned.

Tenders addressed to the Town Clerk, and endorsed "Tenders for ——" (as the case may be) must be delivered to the undersigned not later than 4 p.m. on Monday, February 6th, 1905.

FREDK. RYALL, Town Clerk.

Town Hall, Spa Road, January 23rd, 1905.

COUNTY BOROUGH OF WARRINGTON.

The Water Committee is prepared to receive TENDERS for the SUPPLY of the following MATERIALS for a period of 12 months from the 1st April next :—

Section No. 1.—Pipes, Castings, Valves, Hydrant Covers, &c.
Section No. 2.—Bib, Stop and Ball Cocks, Ferrules, &c.
Section No. 3.—Oils, Packings, &c,
Section No. 4.—Yarn, Washers, Tools, Carting, &c.

Specification and form of Tender may be obtained from the Water Engineer, Municipal Offices, Sankey Street, on payment of 10s. per section, which will be returned on receipt of a *bonâ fide* Tender.

The Contractors whose Tenders are accepted will be required to observe the recognised customs and conditions as to rates of wages and working hours prevailing within the district.

Tenders, in securely fastened envelopes, endorsed "Tender for Material, Section No.——," and addressed to "The Chairman, Water Committee, Town Hall, Warrington," to be delivered not later than 10 a.m. on Saturday, February 11th, 1905.

The lowest or any Tender will not necessarily be accepted.

J. LYON WHITTLE,
Town Clerk.

Town Hall, Warrington,
January 20th, 1905.

POLLOCK and MACNAB, LTD., Britannia Machine Tool Works, Bredbury, Manchester, are open to receive TENDERS FOR ELECTRICALLY DRIVEN TRAVELLING CRANE of the three-motor type, to lift 10 tons at a span of 45 ft. Voltage 220.

TENDERS REQUIRED FOR ALTERNATOR, ENCLOSED ENGINE and BOILER for Electric Lighting in South Africa. For full particulars apply to

A. E. BOOTH and CO.,
16, New Union Street, London, E.C.

MERTHYR TYDFIL WATERWORKS.
HIGH-LEVEL AQUEDUCT.

The Urban District Council of Merthyr Tydfil are prepared to receive TENDERS from Pipefounders, Valve Makers, and others for the SUPPLY and DELIVERY of between 5,700 and 6,000 Tons of CAST IRON PIPES, of diameters ranging from 20 in. to 6 in., and for VALVES and other articles.

Drawings may be seen, and specifications and quantities obtained, on and after Monday, January 30th, 1905, on application at the office of the Engineer, Mr. GEORGE F. DEACON, 16, Great George Street, Westminster, S.W., or at my office at the Town Hall, Merthyr Tydfil, on deposit of a cheque for £2 2s., returnable on receipt of a *bonâ fide* Tender.

Sealed Tenders, endorsed "Tender for Cast Iron Pipes," are to be delivered at my office before Noon on Tuesday, the 14th February, 1905, and the schedule of quantities, with every item legibly priced in ink, and with the columns added up to the exact total amounts of the Tender, must be delivered in a sealed envelope addressed to the Engineer on or before Noon on Wednesday, February 15th, 1905.

The Council do not bind themselves to accept the lowest or any Tender, or to defray any expenses in connection with tendering.

By order,
T. ANEURYN REES,
Clerk to the Council.

Town Hall, Merthyr Tydfil,
January 26th, 1905.

COMMISSIONER FOR RAILWAYS' OFFICE,
BRISBANE, NOVEMBER 16th, 1904.

2,000 TONS OF STEEL RAILS AND 168 TONS OF STEEL FISH-PLATES!

TENDERS WILL BE RECEIVED AT this office until 2 p.m. on Tuesday, the 7th March, 1905, endorsed "Tenders for Steel Rails and Fishplates," and accompanied by a preliminary deposit of 1 per cent. on the Tender.

Specification, &c. (price 10s. 6d. per copy), can be obtained at the office of the Chief Engineer, Brisbane, on and after the 16th day of November, 1904, and also at the office of the Agent-General for Queensland, 1, Victoria Street, London, on and after January 3rd, 1905.

The lowest or any Tender will not necessarily be accepted.

T. S. PRATTEN,
Secretary.

APPOINTMENTS OPEN.

EAST INDIAN RAILWAY.—ASSISTANT LOCOMOTIVE SUPERINTENDENT.
ASSISTANT CARRIAGE AND WAGON SUPERINTENDENT.

The Directors of the East Indian Railway Company are prepared to receive APPLICATIONS (by letter only) from duly qualified candidates for APPOINTMENT as ASSISTANTS in the Locomotive and Carriage and Wagon Departments of the Company in India.

Candidates must have had a good general and technical education, and have served either pupilage or apprenticeship in the loco. or carriage and wagon workshops of a British railway or large loco. or carriage and wagon builders, as the case may be.

Candidates for the loco. appointment should not be less than 25 years of age, and preference will be given to those experienced in workshop supervision.

Salary, Rupees 350, rising to Rupees 400, per calendar month.

Candidates for the carriage and wagon appointment should be about 25 years of age, and preference will be given to those who have had experience in the construction of iron and steel wagon work, as well as the woodwork connected with carriage building and "running" work.

Salary, Rupees 250, rising to Rupees 350, per calendar month.

Terms : A four years' agreement in the first instance, with first-class free passage to India.

The selected candidates will be required to pass a medical examination by the Company's Consulting Physician before appointment.

Letters of application, accompanied by a brief record, in chronological order, of the applicant's career, with dates, together with copies (not originals) of testimonials, and a medical certificate of fitness for residence in India, which cannot be returned, should be addressed to the undersigned not later than Saturday, the 11th February, 1905.

By order,
C. W. YOUNG,
Secretary.

28-30, Nicholas Lane, London, E.C.,
January 19th, 1905.

THE VICTORIA UNIVERSITY OF MANCHESTER.

The Council desires to proceed to the APPOINTMENT of a PROFESSOR of ENGINEERING.

The Professor will be responsible for the organisation of the Engineering Department, and will have the direction of the Engineering Laboratory.

He may take a consulting practice under specified conditions.

His stipend will be composed of a fixed salary and a share of the fees, and the Council guarantee that the total income will not be less than £1,000 per annum during the first three years.

A detailed statement of the conditions of appointment may be obtained from the Registrar.

Applications, with references and such testimonials (not exceeding three in number) as the candidate may desire, should be sent on or before February 15th to the Registrar.

COUNTY BOROUGH OF HUDDERSFIELD.
GAS DEPARTMENT.

APPLICATIONS are INVITED for the POST of DRAUGHTSMAN and ANALYST.

Salary £100 per annum.

For particulars of duties apply to Mr. EDWARD A. HARMAN, M.Inst.C.E., Engineer, Gasworks, Huddersfield.

Applications, stating experience, accompanied by copies of not more than three recent testimonials, must be delivered at the Town Clerk's Office, addressed "Town Clerk, Huddersfield," and endorsed "Draughtsman and Analyst," not later than Tuesday, the 7th day of February, 1905.

Canvassing members of the Council will be deemed a disqualification.

By order,
J. HENRY FIELD,
Town Clerk.

Town Hall, Huddersfield,
January 20th, 1905.

BUYERS' DIRECTORY.

NOTE.—*The display advertisements of the firms mentioned under each heading can be found readily by reference to the Alphabetical Index to Advertisers on pages 23 and 25.*

In order to assure fair treatment to advertisers, each firm is indexed under its leading speciality ONLY.

Advertisers who prefer, however, to be entered under two or more different sections can do so by an annual payment of 5s. for each additional section.

Artesian Well Machinery.
John Z. Thom, Patricroft, Manchester.

Belting.
Binney & Son, Catherine Street. City Road, London, E.C.
Fleming, Birkby & Goodall, Ltd., West Grove, Halifax.
Gilmour, W. & O., St. John's Hill, Edinburgh.
Rossendale Belting Co., Ltd., 10, West Mosley Street, Manchester.

Boilers.
Clayton, Son & Co., Ltd., Leeds City Boiler Works, Leeds.
Grantham Crank & Iron Co., Ltd., Grantham.
John Thompson, Wolverhampton.

Boilers (Water-tube).
Babcock & Wilcox, Ltd., Oriel House, Farringdon Street, London, E.C.
Cochran & Co. (Annan), Ltd., Annan, Scotland.
Hartley & Sugden, Ltd., Halifax.

Bolts, Nuts, Rivets, etc.
Herbert W. Periam, Ltd., Floodgate Street Works, Birmingham.
T. D. Robinson & Co., Ltd., Derby.

Books.
Crosby Lockwood & Son, Stationers' Hall Court, London, E.C.
Griffin, Charles, & Co., Exeter Street, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.
Spon, E. & F. N., 125, Strand, W.C.

Cables.
St. Helen's Cable Co., Ltd., Warrington, Lancashire.

Case-Hardening Compounds.
Hy. Miller & Co., Millgarth Works, Leeds.

Catalogues, Printing, &c.
Atlantic Press, Ltd., Weymouth Street, Manchester.
Southwood, Smith & Co., Ltd., Plough Court, Fetter Lane, London, E.C.
Spottiswoode Advertising Agency, 8, New Street Square, E.C

Chucks.
Fairbanks Co., 78-80, City Road, London, E.C.

Cisterns, Tanks, &c.
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Clutches (Friction).
David Bridge & Co., Castleton Ironworks, Rochdale, Lancashire.

Colliery Plants.
Graham, Morton & Co., Ltd., Leeds.

Condensing Plant.
Concentric Condenser, Ltd., 23, Northumberland Avenue, London, W.C.
Mirrlees-Watson & Co., Ltd., Glasgow.

Condensed Water Purifiers.
Lassen & Hjort, 52, Queen Victoria Street, London, E.C.

Consulting Engineers.
Gibbs, John, & Son, 80, Juke Street, Liverpool.
G. H. Hughes, A.M.I.M.E., 97, Queen Victoria Street, London, E.C.
Melville & Macalpine, 615, Walnut Street, Philadelphia, Pa., U.S.A.

Continental Railway Arrangements.
South Eastern & Chatham Railway Co.

Conveying and Elevating Machinery.
Adolf Bleichert & Co., Leipzig-Gohlis, Germany.
Brown Hoisting Machinery Co., 39, Victoria Street, London, S.W.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Graham, Morton & Co., Ltd., Leeds.
Temperley Transporter Co., 72, Bishopsgate Street Within, London, E.C.

Coverings (Boiler).
Magnesia Coverings, Ltd., Washington Station, co. Durham.

Cranes, Travellers, Winches, etc.
Joseph Booth & Bros. Ltd, Rodley, Leeds.
Thomas Broadbent & Sons, Ltd., Huddersfield.
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

Cranks.
Clarke's Crank & Forge Co., Ltd., Lincoln, England.

Cutters (Milling).
E. G. Wrigley & Co., Ltd., Foundry Lane Works, Soho, Birmingham.

Destructors.
Heenan & Froude, 4, Chapel Walks, Manchester.
Horsfall Destructor Co., Ltd., Armley, Leeds.

Dredges and Excavators.
Delange & Cie, Mce., Hoboken, near Antwerp.
Rose, Downs & Thompson, Ltd., Old Foundry, Hull.

Economisers.
E. Green & Son, Ltd., Manchester.

Ejectors (Pneumatic).
Hughes & Lancaster, 47, Victoria Street, London, S.W.

Electrical Apparatus.
Allgemeine Elektricitäts Gesellschaft, Berlin, Germany.
Broadbent, T. W., Victoria Electrical Works, Huddersfield.
Bruce Peebles & Co., Ltd., Edinburgh.
Brush Electrical Engineering Co., Ltd., Victoria Works Belvedere Road, London, S.E.
Crompton & Co., Ltd., Arc Works, Chelmsford.
Crypto Electrical Co., 3, Tyer's Gateway, Bermondsey Street, London, S.E.
Gent & Co., Ltd., Faraday Works, Leicester.
Greenwood & Batley, Ltd., Albion Works, Leeds.
India Rubber, Gutta Percha, and Telegraph Works Co., Ltd., The Silvertown, London, E.
Mather & Platt, Ltd., Salford Iron Works, Manchester.
Matthews & Yates, Ltd., Swinton, Manchester.
Mix and Genest, Berlin, W., Germany.
Nalder Bros. & Thompson, 34, Queen Street, London, E.C.
Newton Brothers, Full Street, Derby.
Phœnix Dynamo Manufacturing Co., Bradford, Yorks.
Simplex Steel Conduit Co., Ltd., 20, Bucklersbury, London, E.C.
Sturtevant Engineering Co., Ltd., 147, Queen Victoria Street, London, E.C.
Turner, Atherton & Co., Ltd., Denton, Manchester.
B. Weaver & Co., 22, Rosoman Street, Clerkenwell, London, E.C.

Engineers' Supplies.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.

Engines (Electric Lighting).
J. & H. McLaren, Midland Engine Works Leeds.

Engines (Locomotive).
Baldwin Locomotive Works, Philadelphia, Pa., U.S.A
Hunslet Engine Co., Ltd., Leeds, England.
Hudswell, Clarke & Co., Ltd., Leeds, England.

Engines (Stationary).
Allis-Chalmers Co., 533, Salisbury House, Finsbury Circus London, E.C.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
Mirrlees Watson Co., Ltd., Glasgow.
Soest, L., & Co., Ltd., 114-116, Victoria Street, London, S.W.

Engines (Traction).
Jno. Fowler & Co. (Leeds), Ltd., Steam Plough Works, Leeds.
Garrett & Sons, Ltd., Richard, Leiston, R.S.O., Suffolk.

Engravers.
Jno. Swain & Son, Ltd., 58, Farringdon Street, London, E.C.

Exhaust Steam Oil Separators.
Lassen & Hjort, 52, Queen Victoria Street, London, E.C.

Fans, Blowers.
Capel Fan Co., 13, Moseley Street, Newcastle-on-Tyne.
Davidson & Co., Ltd., "Sirocco" Engineering Works, Belfast, Ireland.
Gibbs, John & Son, 80, Juke Street, Liverpool.
James Keith & Blackman Co., Ltd., 27, Farringdon Avenue, London, E.C.
Matthews & Yates, Ltd., Swinton, Manchester.

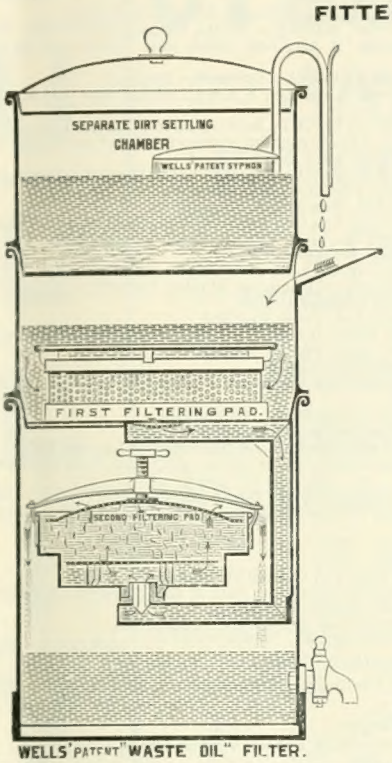
Fire Bricks.
J. H. Sankey & Son, Ltd., Essex Wharf, Canning Town, London, E.
E. J. & J. Pearson, Ltd., Stourbridge.

PAGE'S WEEKLY

Wells' Specialities

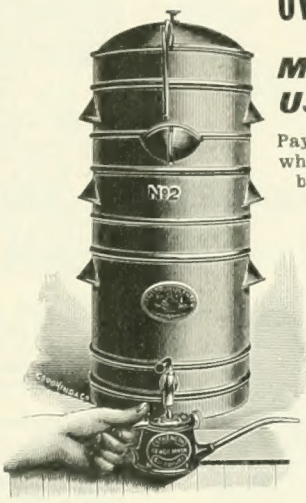
WELLS' PATENT "Waste Oil" FILTERS

FITTED WITH SIGHT-FEED SYPHON.



WELLS' PATENT "WASTE OIL" FILTER.

SUPPLIED TO THE PRINCIPAL COVERNMENTS FOR THE NAVY, DOCKYARDS, &c., AND TO THE LEADING ELECTRIC LIGHT INSTALLATIONS, ENGINEERING WORKS, GAS ENGINE MAKERS, PRINTERS, &c., &c.



OVER *10,000* SOLD.

MONEY SAVERS to any USERS OF MACHINERY.

Pay first cost in a short time, as Dirtied Oil, which has hitherto been thrown away, can be filtered and used again and again.

Write for List of Testimonials and Samples of Work done by the Filter.

No. 1.—For users having only a small quantity of oil to treat (no syphon) 17 in. by 9 in.	35/-
No. 2.—Two top chambers hold about 3 gallons oil, 22 in. by 10 in. ..	50/-
No. 3.—Two top chambers hold about 6 gallons oil, 27 in. by 12 in. ...	70/-
No. 4.—Two top chambers hold about 12 gallons oil, 36 in. by 16 in. ...	110/-
No. 5.—Two top chambers hold about 24 gallons oil, 43 in. by 23 in. ...	189/-
No. 6.—Very powerful Filter for treating large quantities of oil, 54 in. by 30 in.	336/-

Capable of dealing with **250** Galls. Oil per week

LARGER SIZES MADE TO ORDER.

NO OUTSIDE POWER REQUIRED.

LIME, WHITING, OR COLD WATER PAINTS,

Applied at a speed of from 8 to 10 square yards per minute, in a manner superior to brush work.

One coat with the Machine on rough surfaces is equal to two applied with brushes.

Will save First Cost in a Few Days.

No. 6.	Handy Size. No Tank. On Wheels.	£7 7s.
No. 4.	Price, with 5 ft. Pole, Single Spraying Nozzle, and 20 ft. Special Armoured Hose. Capacity 6 gals.	£8 10s.
No. 4A.	Price, with Wheels, 5 ft. Pole, Single Spraying Nozzle, and 20 ft. Special Armoured Hose, **Same capacity as No. 4 Machine.**	£9 10s.
No. 5.	With 5-ft. Pole, Double Spraying Nozzle, and 20 ft. Special Armoured Hose, Large Size. Capacity 10 gals.	£10 10s.
No. 5A.	Ditto Ditto fitted with Wheels.	£11 15s.

WELLS' IMPROVED LIMEWASH.

MUCH SUPERIOR TO ORDINARY LIMEWASH. SLAKED WITH WATER. QUICKLY MIXED. WILL NOT RUB OFF. LEAVES A GOOD SURFACE.

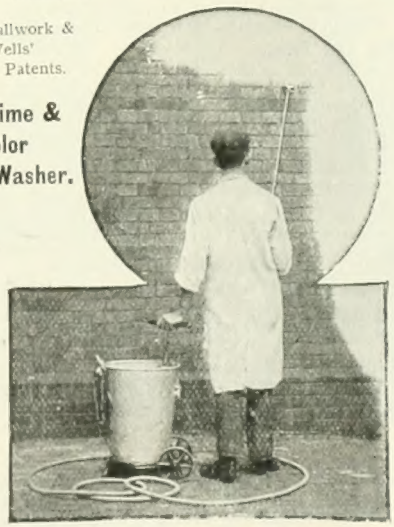
Price 13/8 per cwt.,

Carriage Paid in England and Wales, (If in lots of 3 cwt. at a time, 12/8 per cwt.)

WELLS' "LIGHTNING"

Wallwork & Wells' Patents.

Lime & Color Washer.



No. 4a, with Wheels.

A. C. WELLS & Co.,

100a, Midland Road, St. Pancras,

Works: Cheetham, Manchester. LONDON, N.W.

Buyers' Directory—(*Continued*).

Firewood Machinery.
M. Glover & Co., Patentees and Saw Mill Engineers, Leeds.

Fountain Pens.
Mabie, Todd & Bard, 93, Cheapside, London, E.C.

Forging (Drop) Plants.
Brett's Patent Lifter Co., Ltd., Coventry.

Forgings (Drop).
J. H. Williams & Co., Brooklyn, New York, U.S.A.

Furnaces.
Deighton's Patent Flue & Tube Company, Vulcan Works, Pepper Road, Leeds.
Leeds Forge Co., Ltd., Leeds.
W. F. Mason, Ltd., Engineers, Manchester.

Gas Producers.
Graham, Morton & Co., Ltd., Leeds.
W. F. Mason, Ltd., Engineers, Manchester.
Power-Gas Corporation, Ltd., 39, Victoria Street, London, S.W.

Gauge Glasses.
J. B. Treasure & Co., Vauxhall Road, Liverpool.

Gauges.
Klinger, Richard & Co., 66, Fenchurch Street, London, E.C.

Gearing.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.
Hamilton & Co., J. B., 145, Cannon Street, E.C
Wild, M. B., & Co., Corporation Street, Birmingham.

Gold Dredging Plant.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.

Greases.
Blumann and Stern, Ltd., Plough Bridge, Deptford, London, S.E.

Hammers (Steam).
Davis & Primrose, Leith Ironworks, Edinburgh.
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

Hoisting Machinery.
See Conveying Machinery.

Horizontal Boring Machines.
Greenwood & Batley, Albion Works, Leeds.
Niles-Bement Pond Co., 23-25, Victoria Street, London, S.W.

Hydraulic Leather.
Ahlers, Ad., Whitley Bay, near Newcastle-on-Tyne.

Icemaking and Refrigerating Machinery.
H. J. West & Co., 114-118, Southwark Bridge Road, London, S.E.

Indicators.
Dobbie McInnes, Ltd., 41 & 42, Clyde Place, Glasgow.
Hannan & Buchanan, 75, Robertson Street, Glasgow.

Iron and Steel.
Askham Bros. & Wilson, Ltd., Sheffield.
Consett Iron Co., Ltd., Consett, Durham, and Newcastle-on-Tyne.
Fairley & Sons, James, Old Mint, Shadwell Street, Birmingham.
Farnley Iron Co., Ltd., Leeds England.
Fried. Krupp, Grusonwerk, Magdeburg-Buckau, Germany.
Hadfield's Steel Foundry Co., Ltd., Sheffield.
J. Frederick Melling, 14, Park Row, Leeds, England.
Parker Foundry Co., Derby.
Purden, John & Sons, Lambhill Forge, by Maryhill, Glasgow.
Walter Scott, Ltd., Leeds Steel Works, Leeds, England.
Gilbert Thompson & Co., 116, Victoria Street, London, S.W.

Ironwork (Constructional).
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Ironwork (Galvanised).
F. A. Keep, Juxon & Co., Barn Street, Birmingham.

Jointing Materials.
Richard Klinger & Co., 66, Fenchurch Street, London, E.C.

Lagging Sheets.
Zeitz & Co., 21, Lime Street, London, E.C.

Lathes.
Bradbury & Co., Ltd., Wellington Works, Oldham.
Leckenby, Benton, & Co., Perseverance Ironworks, Halifax
Northern Engineering Co. (1900) Ltd., King Cross, near Halifax.

Laundry Machinery.
W. Summerscales & Sons, Ltd., Engineers, Phœnix Foundry, Keighley, England.

Lifts.
Waygood & Co., Ltd., Falmouth Road, London, S.E.

Lubricants.
Blumann & Stern, Ltd., Plough Bridge, Deptford, London, S.E.
Reliance Lubricating Oil Co., The, 19 & 20, Water Lane, Great Tower Street, London, E.C.
Matthew Wells & Co., Hardman Street Oil Works, Manchester.

Machine Tools.
George Addy & Co., Waverley Works, Sheffield.
Bateman's Machine Tool Co., Hunslet, Leeds.
Hy. Berry & Co., Ltd., Leeds.
Bertrams, Ltd., St. Katherine's Works, Sciennes, Edinburgh.
Bradbury & Co., Ltd., Wellington Works, Oldham.
Breuer, Schumacher & Co., Ltd., Kalk, near Cologne-on-Rhine (Germany).
Britannia Engineering Co., Ltd., Colchester, England.
C. W. Burton Griffiths and Co., 1, 2, & 3, Ludgate Square, Ludgate Hill, London, E.C.
Chas. Churchill & Co., Ltd., 9-15, Leonard Street, London, E.C.
Cunliffe & Croom, Ltd., Broughton Ironworks, Manchester.
Greenwood & Batley, Ltd., Leeds.
Jones & Lamson Machine Co., 97, Queen Victoria Street, London, E.C.
John Lang & Sons, Johnstone, near Glasgow.
Luke & Spencer, Ltd., Broadheath, Manchester.
Jos. C. Nicholson Tool Co., City Rd. Tool Wks., Newcastle-on-Tyne.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Noble & Lund Ltd., Felling-on-Tyne.
Northern Engineering Co., 1900, Ltd., King Cross, near Halifax.
J. Parkinson & Son, Canal Ironworks, Shipley, Yorkshire.
C. Redman & Sons, Halifax.
Rice & Co. (Leeds), Ltd., Leeds, England.
Wm. Ryder, Ltd., Bolton, Lancs.
G. F. Smith, Ltd., South Parade, Halifax.
John Stirk & Sons, Halifax.
Taylor and Challen, Ltd., Derwent Foundry, Constitution Hill, Birmingham.
H. W. Ward & Co., Lionel Street, Birmingham.
T. W. Ward, Albion Works, Sheffield.
West Hydraulic Engineering Co., 23, College Hill, London, E.C.
Whitman & Barnes Manufacturing Co., 149, Queen Victoria Street, London, E.C.
Charles Winn & Co., St. Thomas Works, Birmingham.
Yorkshire Machine Tool and Engineering Works, Liversedge, Yorks

Metals.
Delta Metal Co., Ltd., 110, Cannon Street, London, E.C.
Magnolia Anti-Friction Metal Co., Ltd., of Great Britain, 49, Queen Victoria Street, London, E.C.
Phosphor Bronze Co., Ltd., Southwark, London, S.E.

Metals (Perforated).
W. Barns & Son, Chalton Street, Euston Road, London, N.W.

Mining Machinery.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.

Office Appliances.
Addressograph Ltd., 91 and 92, Shoe Lane, London, E.C.
Halden & Co., J., 8, Albert Square, Manchester.
Hall & Co., B. J., 39, Victoria Street, London, S.W.
Lyle Co., Ltd., Harrison Street, Gray's Inn Road, London, W.C.
Partridge & Cooper, Ltd., 191-192 Fleet Street, London, E.C.
Rockwell-Wabash Co. Ltd., 69, Milton Street, London, E.C.
Shannon, Ltd., Ropemaker Street, London, E.C.
Titan Binder Co., 31, Queen Victoria Street, London, E.C.
Trading and Manufacturing Co., Ltd., Temple Bar House Fleet Street, London, E.C.

Oils, &c.
Blumann and Stern, Ltd., Plough Bridge, Deptford, London, S.E.
Wells, M., & Co., Hardman Street Oil Works, Manchester.

Packing.
Beldam Packing & Rubber Co., 93-94, Gracechurch Street, London, E.C.
Frictionless Engine Packing Co., Ltd., Hendham Vale Works, Harpurhey, Manchester.
Lancaster & Tonge, Ltd., Pendleton, Manchester.
Redfern & Co., S., Swan Lane, New Brown Street, Manchester.
Quaker City Rubber Co., Coronation House, Lloyd's Avenue, E.C.
United Kingdom Self-Adjusting Anti-Friction Metallic Packing Syndicate, 14, Cook Street, Liverpool.
United States Metallic Packing Co., Ltd., Bradford,
J. Bennett von der Heyde, 6, Brown Street, Manchester.

Paint (Metallic).
Metallic Paint Co., Ltd., Cardiff.

Paper.
Lepard & Smiths, Ltd., 29, King Street, Covent Garden, London, W.C.

Patent Agents.
Page & Rowlingson, 28, New Bridge Street, London, E.C.

Buyers' Directory—(*Continued*).

Photo Copying Frames.

J. Halden & Co., 8, Albert Square, Manchester.
B. J. Hall & Co., 30, Victoria Street, London, S.W.

Photographers.

Booker & Sullivan, 67 and 68, Chancery, London, W.C.
Elliott & Fry, 55, Baker Street, London, W.

Photographic Apparatus.

Marion & Co., Ltd., 22, 23, Soho Square, London, W.

Pinch Bars.

Samson & Co., Garforth, near Leeds.
Stone & Co., J. B., 138, Finsbury Pavement, London, E.C.

Pistons.

Lancaster & Tonge, Ltd., Pendleton, Manchester.

Planished Sheets.

Zeal & Co., 21, Lime Street, London, E.C.

Porcelain.

Gustav Richter, Charlottenburg, near Berlin, Germany.

Presses (Hydraulic).

Greenwood & Batley, Albion Works, Leeds.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.

Publishers.

Crosby Lockwood & Son, 7, Stationers' Hall Court, London, E.C.
Charles Griffin & Co., Ltd., Exeter Street, Strand, London, W.C.
Spon, E. and F. N., 125, Strand, W.C.
New Zealand Mines Record, Wellington, New Zealand.

Pulleys.

H. J. H. King & Co., Nailsworth, Glos.

Pumps and Pumping Machinery.

Blake & Knowles Steam Pump Works, Ltd., 153, Queen Victoria Street, London, E.C.
Drum Engineering Co., 27, Charles Street, Bradford.
Enke, Carl, Schkeuditz-Leipzig, Germany.
Fairbanks, Morse & Co., 126, Southwark Street, London, S.E.
Fraser & Chalmers, Ltd., 3, London Wall Buildings, London, E.C.
J. P. Hall & Sons, Ltd., Peterborough.
Hathorn, Davey & Co., Ltd., Leeds, England.
Positive Rotary Pumps, Ltd., 23, Northumberland Avenue, London, W.C.
Tangyes, Ltd., Cornwall Works, Birmingham.

Radial Drilling Machines.

Greenwood & Batley, Albion Works, Leeds.
Niles-Bement-Pond Co., 23-25, Victoria Street, London, S.W.
Northern Engineering Co. (1900), Ltd., King Cross, near Halifax.

Rails.

Wm. Firth, Ltd., Leeds.

Railway Wagons.

Nye, A. W., 110, Cannon Street, London, E.C.
W. R. Renshaw & Co., Ltd., Phœnix Works, Stoke-on-Trent.

Riveted Work.

F. A. Keep, Juxon & Co., Forward Works, Barn Street, Birmingham.

Roofs.

D. Anderson & Son, Ltd., Lagan Felt Works, Belfast.
Graham, Morton & Co., Ltd., Leeds.
Head, Wrightson & Co., Ltd., Thornaby-on-Tees.

Ropeways (Aerial).

Bullivant & Co., Ltd., 72, Mark Lane, London, E.C.

Scientific Instruments.

Cambridge Scientific Instrument Co., Ltd. Cambridge.

Stampings.

Thos. Smith's Stamping Works, Ltd., Coventry.
Thomas Smith & Sons (of Saltley), Ltd., Birmingham.

Stamps (Rubber).

Rubber Stamp Co., 1 & 2, Holborn Buildings, Broad Street Corner, Birmingham.

Stamps (Metal).

Edward Pryor & Son, 68, West Street, Sheffield.

Steam Traps.

British Steam Specialties, Ltd., Fleet Street, Leicester.
Lancaster & Tonge, Ltd., Pendleton, Manchester.

Steam Wagons.

Thornycroft & Co., Ltd., J. I., Chiswick, London, W.
Yorkshire Patent Steam Wagon Co., Pepper Road, Hunslet, Leeds.

Steel Tools.

Saml. Buckley, St. Paul's Square, Birmingham.
Pratt & Whitney Co., 23-25, Victoria Street, London, S.W.

Stokers.

Ed. Bennis & Co., Ltd., Bolton, Lancs.
Meldrum Brothers, Ltd., Atlantic Works, Manchester.

Stone Breakers.

S. Pegg & Son, Alexander Street, Leicester.

Superheaters.

A. Bolton & Co., 40, Deansgate, Manchester.

Time Recorders.

Howard Bros., 10, St. George's Crescent, Liverpool, and 100c, Queen Victoria Street, London, E.C.
International Time Recording Co., 171, Queen Victoria Street, London, E.C.

Tubes.

Premier Boiler Tubes, Ltd., 28, Victoria Street, London, S.W.
Thomas Piggott & Co., Ltd., Spring Hill, Birmingham.
Tubes, Ltd., Birmingham.

Turbines.

G. Gilkes & Co., Ltd., Kendal.
Greenwood & Batley, Albion Works, Leeds.
S. Howes, 64, Mark Lane, London, E.C.

Typewriters.

Elliott-Fisher Co., 85, Gracechurch Street, London, E.C.
Empire Typewriter Co., 77, Queen Victoria Street, London, E.C.
Yost Typewriter Co., 50, Holborn Viaduct, London, E.C.

Valves.

Alley & MacLellan, Ltd., Glasgow.
Holmes & Co., W. C., Huddersfield.
Scotch and Irish Oxygen Co., Ltd., Rosehill Works, Glasgow.
Shaw, Joseph, Albert Works, Huddersfield.

Ventilating Appliances.

Matthews & Yates, Ltd., Swinton, Manchester.

Wagons—Steam.

Thornycroft & Co., J. I., Ltd., Chiswick, London, W.

Water Softeners.

Lassen & Hjort, 52, Queen Victoria Street, London, E.C.

Weighing Apparatus.

W. T. Avery & Co., Soho Foundry, Birmingham, England.
Samuel Denison & Son, Hunslet Moor, near Leeds.
Graham, Morton & Co., Ltd., Leeds.

Wells Light.

A. C. Wells & Co., 100A Midland Road, St. Pancras, London, N.W.

Wind and Water Supply Machinery.

Eric S. A. Smith, Bridlington.

Wire Working Machinery.

Ed. Brand, 35, Shakespeare Street, Manchester.

"Woodite."

"Woodite" Company, Mitcham, Surrey.

PAGE'S WEEKLY — Machine Tools

DON'T FORGET

Lathes, Planers, and Shapers

ARE OUR SPECIALITIES.

High-Grade Machines Only in Stock for Immediate Delivery.

C. Redman & Sons,

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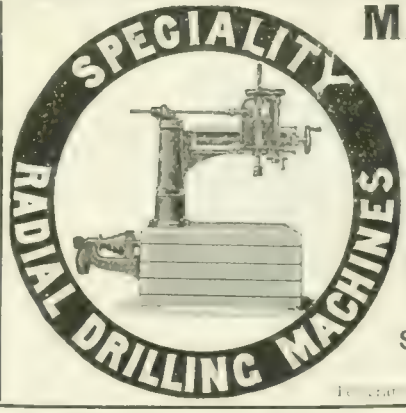

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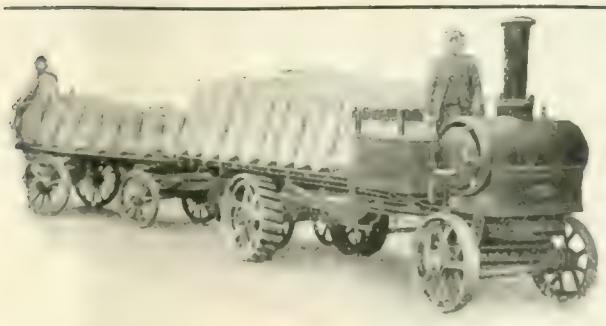

This illustration is of a Steam Wagon [illegible] and haul 4 Tons on a Trailer.

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PAGE'S WEEKLY — Machine Tools

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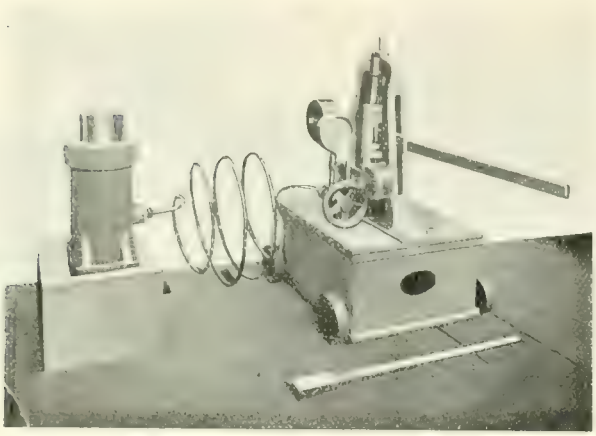

BOILER FLUE APPARATUS

This illustration shows an apparatus for pushing up boiler flues. The cylinder and ram can be got into a flue of 24 in. diameter, and is capable of dealing with plates up to $\frac{3}{4}$ in. of thickness cold.

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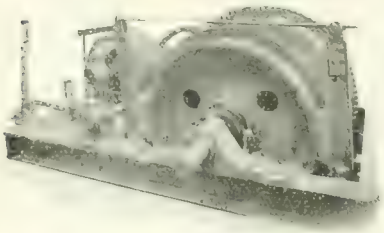

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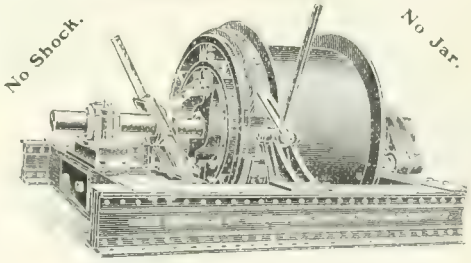

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PAGE'S WEEKLY — Machine Tools

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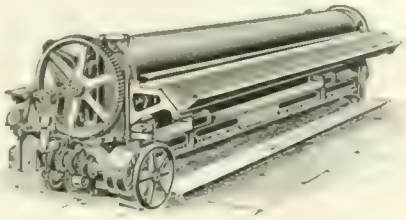

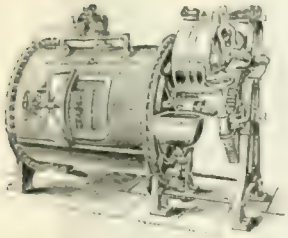

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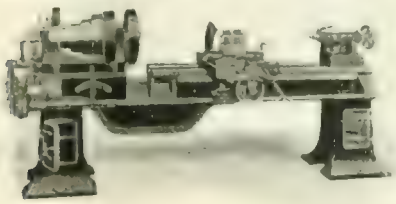

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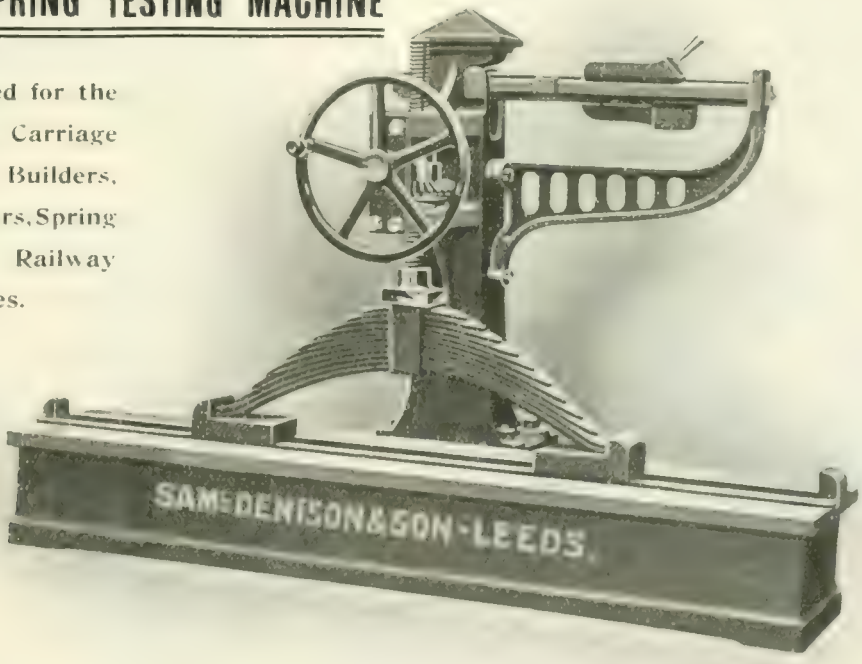

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PAGE'S WEEKLY — Machine Tools

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Makers of . . .

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Address: **Hunslet, LEEDS.**

OUR PATENT MACHINES

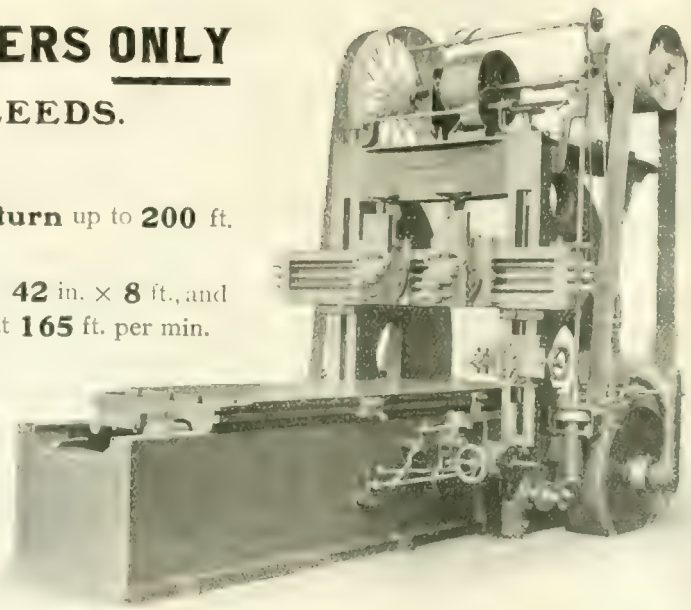
Cut up to **80** ft. per min. and **Return** up to **200** ft. per min. according to size.

The Machine illustrated is a **42** in. × **42** in. × **8** ft., and **Cuts** at **60** ft. per min., **Returns** at **165** ft. per min.

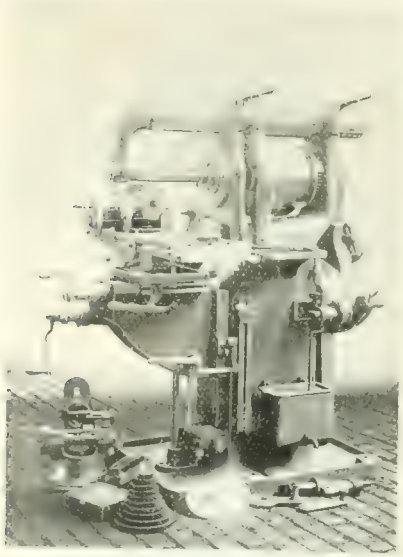
With Two Tools at $\frac{1}{8}$ in. feed, it will plane **4,032** sq. in. in **30** to **35** mins.

With a cut $\frac{3}{8}$ in. deep, at $\frac{1}{8}$ in. feed, it will remove nearly **½-TON** of metal per **hour.**

Our **60** in. × **60** in. × **12** ft. Planer **Cuts** at **60** ft. per min., **Returns** at **130** ft. per min.



42 in. × 42 in. × 8 ft. PATENT HIGH-SPEED PLANER.



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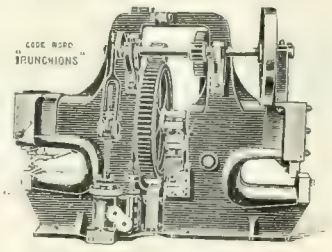

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PAGE'S WEEKLY — Packings

Index to Advertisers.

Advertisements not appearing this week will be found by reference to the preceding or following issues, with the exception of those appearing monthly.

PAGE'S WEEKLY — Miscellaneous

Index to Advertisers—(Contd.)

PAGE'S WEEKLY

Miscellaneous

PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

VOL. VI. LONDON, FRIDAY, FEBRUARY 3, 1905. No. 21.

The Offices of "Page's Weekly," Wednesday, Midnight.

IN pursuing the transference of heat from the fuel to the water in the boiler, it becomes necessary to consider the effect of heat upon water. The specific heat of water, or the quantity of heat required to raise its temperature, is greater than that of any other known substance. Consequently the specific heats of all other substances (water being taken as unity) are stated as decimal fractions. The specific heat of steel boiler-plate for example is 0·117, so that the quantity of heat which would raise the temperature of water one degree, would suffice to heat nearly 8½ times the weight of steel to the same extent.

From the temperature of melting ice up to the boiling point, or through a range of 180 deg. F., the absorption of heat by the water is regularly measurable by the thermometer; and disregarding the expansion of the water, practically a negligible quantity, we may say that to each pound of water 180 heat-units have been imparted. But to convert this pound of water, already at the boiling point, into steam at atmospheric pressure, requires 966 heat-units, or more than 5⅓ times the amount, and this without raising the temperature in the least. This considerable amount of mechanical work, or 966 × 772 = 745,752 foot-pounds, is only partly accounted for by the visible or external work performed, namely, the expansion of volume against the resistance of the atmosphere.

Steam at atmospheric pressure occupies a volume 1,646 times that of the water from which it was formed, or 26·37 cubic feet per pound. It has consequently displaced exactly

MR. CHARLES CONRAD SCHNEIDER.
President of the American Society of Civil Engineers.

At the age of [illegible] the Engineering News of New York, to which we [illegible] the above photo. Mr. C. C. Schneider was born at Apolda in the Duchy of Saxe-Weimar, Germany, in the year 1843. [illegible] graduated from the Royal School of Engineering at Carlsruhe. He went to America in 1866, and for the first thirty years he [illegible] engineering work in the United States.

that volume of air at a pressure of 14·7 lb. per square inch, or 2,117 lb. per square foot. This represents the external work amounting to $2{,}117 \times 26{\cdot}37 = 55{,}825$ pounds lifted one foot high, leaving nearly 690,000 foot-pounds as the mechanical equivalent of the heat expended in overcoming molecular attraction. If we divide these two results by 772, the mechanical equivalent of heat, we find the external work amounts to 72·3 heat-units, and the internal or molecular work to 893·6, making up the well-known value of 966 heat-units, the British unit of evaporation.

In comparing the performances of steam-boilers, working at different pressures, and taking their feed-water at different temperatures, it becomes necessary to reduce the actual results to a common standard, in which the evaporation is assumed to take place at atmospheric pressure, and the feed-water to be supplied at 212 deg. F., generally known as "from and at 212." Supposing for the moment the feed-water to be supplied at 0 deg. F., we should evidently require 966 plus 212 = 1,178 units of heat to evaporate each pound of water, and so for any temperature of feed-water, say 65 deg., the heat-units required would be 1,178—65; or, generally, for evaporation at atmospheric pressure, 1,178—t; t being the temperature of feed-water. In most tables of the properties of saturated steam, the total heat is given as from 32 deg., reducing the figure 1,178 to 1,146, or, as more exactly stated, 1,146·6, which gives us the trouble of subtracting 32 in each case, when the temperature of the feed comes into the question. The total heat of steam increases but slowly in relation to the pressure, being at the rate of ·305 of a heat-unit for each degree Fahrenheit above 212 deg. On referring to a table we find the temperature of steam at 60 lb. pressure above the atmosphere to be 307·2 deg. Hence the total heat is 1·146.6 + ·305 (307—212) = 1,176. Double the pressure, and the total heat is only 1,146·6 + ·305 (350 — 212) = 1,189. Dividing these two results by the unit of evaporation, 966, we find the figures respectively to be 1·217 units, and 1·230 units. So that it costs little more to work at 120 lb. pressure than at 60 lb. Even at 160 lbs. pressure the heat supplied is only 1·236 units. These figures are significant in relation to the economy attending the use of steam at higher pressures.

To reduce the performance of a boiler working at 120 lb. pressure above the atmosphere supplied with feed-water at 60 deg. to the equivalent evaporation from and at 212 deg., the total heat of 120 lb. steam from the table of saturated steam is 1,189, and subtracting 32 deg. from the temperature of the feed-water, we have $\frac{1189-28}{966} = 1.2$; and this multiplied by the evaporative power of the boiler under the given conditions, say 9 lb. of water per lb. of coal, will give $9 \times 1{\cdot}2 = 10{\cdot}8$ lb. of water evaporated from and at 212 deg.

Feed-water heaters are employed to utilise the escaping heat of the exhaust steam. Taking an extreme case, that of raising the feed-water from the freezing to the boiling point, or through 180 deg., we have the ratio $\frac{1,146-180}{1,146} = {\cdot}843$ or 15·7 per cent. as the saving effected. This, of course, is out of the question. Taking more reasonable figures, say feed-water at 50 deg., and that this is heated up by the exhaust steam to 175 deg. Subtracting 32 deg. in each case, we have $\frac{1,146-143}{1,146-18} = {\cdot}888$, or 11·2 per cent. As the cost of an efficient feed-heater is by no means excessive, and the cost of maintenance resolves itself mainly into keeping the tube surfaces free from deposit, the saving effected, though not so large as sometimes professed, is, nevertheless, very well worth the outlay.

From the Painting in the Society of Arts.

THE LATE SIR FREDERICK ABEL, BART., D.C.L., F.R.S.

From the Painting by Mr. Seymour Lucas, R.A., presented to the Society of Arts by Mr. Henry Graham Harris.

TABLE SHOWING THE OUTPUT OF COAL IN THE UNITED KINGDOM, ITS PIT'S MOUTH VALUE, THE QUANTITY SHIPPED FOR FOREIGN COUNTRIES IN THE FORM OF COAL, COKE, AND PATENT FUEL, THE TOTAL QUANTITY SHIPPED, INCLUDING COAL, SHIPPED FOR THE BUNKERS OF STEAMERS ENGAGED IN THE FOREIGN TRADE, THE QUANTITY REMAINING FOR HOME CONSUMPTION AND ITS PROPORTION TO EACH HEAD OF THE POPULATION FOR THE YEARS 1870 TO 1903.

Year	(1.) Total Output.	(2.) Average Value per Ton at the Pit Mouth.§	(3.) Coal Exported.	(4.) Percentage of Total Output Exported as Coal	(5.) Coke Exported.	(6.) Coal Equivalent of Coke Exported.*	(7.) Patent Fuel Exported.	(8.) Coal contained in Patent Fuel Exported.†	(9.) Coal shipped for the bunkers of Steamers engaged in Foreign Trade.‡	(10.) Total Coal Shipped, Columns 3, 6, 8, and 9.	(11.) Percentage of Total Output Shipped.	(12.) Quantity remaining for Home Consumption for all purposes	(13.) Population of the United Kingdom.	(14.) Quantity of Coal remaining for Home Consumption per head of the Population.
	Tons.	s. d.	Tons.		Tons.	Tons.	Tons.	Tons.	Tons	Tons.		Tons.		Tons.
1870	110,431,192	—	11,177,976	10·12	326,296	543,826	198,377	178,539	No records	—	—	—	—	—
1871	117,352,028	—	12,208,009	10·40	341,865	569,775	198,115	178,303	,,	—	—	—	—	—
1872	123,497,315	—	12,712,231	10·21	279,022	465,036	207,241	186,516	,,	—	—	—	—	—
1873	128,680,131	—	12,077,507	9·38	261,619	436,082	278,410	250,569	3,312,470	16,076,628	12·49	112,603,503	32,177,550	3·499
1874	126,590,108	—	13,381,071	10·57	236,240	393,733	309,894	278,905	3,140,383	17,194,092	13·58	109,396,016	32,501,517	3·366
1875	133,306,485	—	13,978,956	10·48	307,629	512,715	258,331	232,497	3,278,249	18,002,417	13·50	115,304,068	32,838,758	3·511
1876	134,125,166	—	15,690,402	11·69	326,707	544,512	281,968	253,771	3,564,524	20,053,209	14·95	114,071,957	33,199,994	3·436
1877	134,179,968	—	14,880,899	11·09	333,640	556,067	205,511	184,960	3,661,552	19,283,478	14·37	114,896,490	33,575,941	3·422
1878	132,612,063	—	14,998,527	11·31	274,239	457,065	221,867	199,680	4,018,010	19,673,282	14·83	112,938,781	33,943,773	3·327
1879	133,720,393	—	15,740,082	11·77	345,438	575,730	356,776	321,098	4,401,120	21,038,030	15·73	112,682,363	34,302,557	3·285
1880	146,969,409	—	17,891,181	12·17	442,797	737,995	385,993	347,394	4,926,076	23,902,646	16·27	123,066,763	34,622,930	3·554
1881	154,184,300	—	18,759,991	12·16	414,762	691,270	412,310	371,079	5,227,588	25,049,928	16·18	129,134,372	34,934,476	3·696
1882	156,499,977	5 7·66	19,926,011	12·73	466,249	777,082	542,188	487,969	5,575,160	26,766,222	17·10	129,733,755	34,206,617	3·685
1883	163,737,327	5 7·50	21,670,926	13·23	488,001	813,335	616,707	555,036	6,400,594	29,439,891	17·90	134,297,436	35,449,721	3·788
1884	160,757,779	5 4·86	22,354,474	13·90	476,291	793,818	519,465	467,518	6,614,937	30,230,747	18·80	130,527,032	35,724,231	3·654
1885	159,351,418	5 1·96	22,710,335	14·25	548,375	913,958	512,247	461,022	6,681,359	30,766,674	19·30	128,584,744	36,015,601	3·570
1886	157,518,482	4 10·12	22,107,144	14·03	650,311	1,083,852	525,934	473,341	6,698,238	30,362,575	19·27	127,155,907	36,313,582	3·501
1887	162,119,812	4 9·87	23,258,855	14·34	661,931	1,103,218	540,181	486,163	6,868,790	31,717,026	19·56	130,402,786	36,599,143	3·563
1888	169,935,219	5 0·69	25,632,407	15·08	798,254	1,330,423	539,875	485,887	7,121,393	34,570,110	20·34	135,365,109	36,881,271	3·670
1889	176,916,724	6 4·21	27,504,911	15·54	769,480	1,282,467	682,054	613,849	7,736,794	37,138,021	20·99	139,778,703	37,178,929	3·760
1890	181,614,288	8 3·05	28,738,241	15·82	732,375	1,220,625	672,223	605,001	8,096,405	38,660,272	21·28	142,954,016	37,484,764	3·814
1891	185,479,126	7 11·88	29,496,785	15·03	859,543	1,432,572	727,788	655,009	8,536,495	40,120,861	21·63	145,358,265	37,796,300	3·846
1892	181,786,871	7 3·20	29,048,056	15·97	609,451	1,015,752	796,466	716,819	8,600,129	39,380,756	21·66	142,406,115	38,103,519	3·737
1893	164,325,795	6 9·51	27,708,128	16·86	602,774	1,004,623	721,053	648,947	8,126,372	37,488,070	22·81	126,837,725	38,434,629	3·300
1894	188,277,525	6 7·43	31,756,368	16·86	588,266	980,443	729,064	656,158	9,294,461	42,687,430	22·67	145,590,095	38,777,687	3·755
1895	189,661,362	6 0·42	31,714,906	16·72	700,064	1,166,773	686,482	617,834	9,407,789	42,907,302	22·64	146,754,060	39,113,465	3·752
1896	195,361,260	5 10·26	32,947,680	16·86	676,811	1,128,018	637,565	573,808	9,937,305	44,586,811	22·81	150,774,449	39,464,582	3·820
1897	202,129,931	5 10·93	35,354,296	17·49	978,327	1,630,545	764,295	687,865	10,455,758	48,128,464	23·81	154,001,467	39,825,357	3·867
1898	202,054,516	6 4·22	35,058,430	17·34	769,742	1,282,903	734,624	661,162	11,264,204	48,266,699	23·88	153,787,817	40,190,797	3·826
1899	220,094,781	7 7·03	41,180,332	18·71	867,295	1,445,492	1,063,777	957,399	12,226,801	55,810,024	25·36	164,284,757	40,555,623	4·051
1900	225,181,300	10 9·66	44,089,197	19·57	985,365	1,642,275	1,023,666	921,299	11,752,316	58,405,087	25·93	166,776,213	40,921,371	4·075
1901	219,046,945	9 4·29	41,877,081	19·11	807,671	1,346,118	1,081,160	973,044	13,586,833	57,783,076	26·37	161,263,869	41,544,145	3·882
1902	227,095,042	8 2·84	43,159,046	19·00	688,646	1,147,743	1,050,256	945,230	15,148,115	60,400,134	26·59	166,694,908	41,952,510	3·973
1903	230,334,469	7 7·93	44,950,057	19·51	717,477	1,195,795	955,166	859,649	16,799,848	63,805,000	27·70	166,529,469	42,373,800	3·930
Total	5,694,928,507	—	855,740,498	15·02	19,332,983	32,221,638	19,437,029	17,493,320	—	—	—	—	—	—

* The figures under column (6) have been computed on the assumption that for every 60 tons of coke exported, 100 tons of coal were consumed in its manufacture.
† The patent fuel exported has been assumed to contain 90 per cent. of coal; the remaining 10 per cent. consisting mainly of pitch.
‡ The figures given under this heading relate to the coal shipped on board British and Foreign passenger and cargo steamers bound for foreign ports.

FROM THE REPORT OF THE ROYAL COMMISSION ON COAL SUPPLIES. (See page 256.)

PAGE'S WEEKLY

An Illustrated Technical Weekly, dealing with the Engineering, Electrical, Mining, Iron and Steel, and Shipbuilding Industries.

DAVIDGE PAGE, Editor.

Clun House, Surrey Street, Strand, London, W.C.

Telephone No. 4[illegible] LEGAL[illegible]

Telegraphic Address: [illegible] "SINEWY, LONDON."

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New Copy for Advertisements,

Advertisements intended for insertion in the current week's issue must be received **not later than 4 p.m. on Monday.** Proofs of the copy and blocks should reach us several days earlier.

NEWS ITEMS.

The towing competition between the battleship *Victorious* and *Magnificent* at Devonport on Monday, the latter as the Fleet tug, took on board 1,500 tons in 12 minutes 12 seconds, while the *Magnificent* was engaged for 17 minutes in performing the same task.

The second one of the new scouts, during her official steam trials, maintained a speed during an eight hour test of 25.44 knots, this being a quarter of a knot in excess of the guarantee given by the contractors, Messrs. Vickers, Sons and Maxim.

A proposal is on foot to provide Venice with new docks, which if carried out will be of the greatest importance to British coaling vessels. The proposed docks will have more than two and a half miles' frontage, the cost being estimated at £1,000,000.

It is stated that the Government have determined to take no steps for the creation of a ministry of commerce, and circulars are to be issued calling on the Associated Chambers of Commerce to bring all pressure to bear on the Government to reconsider the situation.

Replying to the toast "Our Guests" at the sixth annual dinner of the University College, Colston Society, Bristol, Sir Oliver Lodge, urged that the citizens should put forth their energies for the creation of a University College, because it would be a great educational centre of influence. With a University Bristol should be the educational capital of the west.

The Secretary of State for India has now sanctioned the proposals for financing the scheme adopted by the local government for the improvement of Madras harbour. The scheme provides for the closing of the present exposed harbour entrance, and the opening of another in the north-east wall of the harbour which will be protected by a breakwater about [illegible] ft. long. The cost of the scheme is estimated at £306,666.

The official abstract of the new German treaties of commerce has been completed. Under the heading of machinery the system of admitting certain important materials for ship building without duty is maintained, as in the case of ships' engines and boilers. But industrial machinery and mechanical tools are subjected to heavier duties. Motor carriages and bicycles will be charged for according to weight on a scale ranging from 11s. to £3 per [illegible] kilogrammes.

The 3,032 Carat Diamond.

The finding of a diamond weighing 3,032 carats on the Premier Mine has created quite a flutter in Hatton Garden. Even the most callous dealer in diamonds has never handled anything approaching the new diamond in size. As for the mining press it has been jagging, with the intricate mysteries of troy weight and some writers who have emerged from the ordeal limp and pallid, have given the result of their abstruse calculations. One is bound to say that there is not absolute agreement as to the weight of the new stone when translated from carats into mere ounces for while one writer modestly contents himself with the statement that the diamond weighs a shade over 1lb. another mining statistician boldly asserts that the new Premier diamond weighs over a hundredweight. It will, perhaps, be interesting in view of this confusion of ideas to make a comparison between the new monster diamond and other famous gems.

South Africa produced a big diamond in 1893, when the "Excelsior," which weighed 970 carats, was found at Jagerstontem. The largest diamond up to the present time has been the famous "Braganza," now in the possession of Portugal which in its uncut state weighed 1680 carats. The "Braganza" is a Brazilian stone, but opinions differ as to whether it is a true diamond. The famous "Koh-i-nor" is an Indian stone believed to have been found in the ground along the banks of the Kistna and Godaveri rivers, and the same source, claimed as the Golconda of tradition, is said to have yielded the "Regent" and the "Great Mogul."

The "Regent," one of the gems of the old French Crown weighed in the rough state 410 carats. The

	Composition.	Specific Gravity.	Melting Point. Deg. Cent.	Spec. Res.	Temp. Co-ef. per Deg. Cent.
Aluminium Bronze ..	Cu. 90% Al. 10%	7·69	930	12·6	·00105
Brass	Cu. 65·8% Zn. 34·2%	8·39	1020	6·3	·00158
Chrome Steel	.....	..	..	19·4	..
German Silver	Cu. 60% Zn. 25% Ni. 15%	8·5	1100	30	·00036
Manganin	Cu. 84% Mn. 12% Ni. 4%	8·9	..	46·7	..
Manganese Steel.. ..	.....	7·8	1260	69	·00135
Manganese Copper ..	Cu. 70% Mn. 30%	..	..	101	·00004
Platinoid	.....	8·8	..	41·7	00082
Phosphor Bronze ..	Cu. Sn. P.	8·9	..	..	..
Silicon Bronze	Cu Sn. Si.	8·9	..	..	..
Tungsten Steel	.....	..	..	22·5	..

	Approx. Mean Specific Gravity.	Melting Point, Roberts-Austen. Deg. Cent.	Specific Heat. Regnault.	Elongation o/o per Deg. Cent. Clark.	Spec. Res. Microhms per C.C. at 0° Cent.	Temp. Co-ef. per Deg. Cent.
Aluminium ..	2·67	625	·2122	·0022	2·56	·00423
Copper	8·853	1055	·0951	·0016	1·59	·00388
Gold	19·3	1045	·0324	·0014	2·2	·00377
Iron Wrought..	7·7	1600	·1138	·0012	9·07	·00625
do. Cast	7·218	1220	·1298	·001	..	..
Lead	11·38	326	0314	·0028	20·4	·00411
Mercury	13·6	−40	·032	·01797*	94·3	·00072
Nickel..	8·81	1450	·1092	·00125	12·3	·0062
Platinum	21·51	1775	·0324	·00086	11	·0035
Silver	10·5	945	·057	·0019	1·47	·004
Tin	7·3	230	·0562	·0021	13·1	·0044
Zinc	7	415	·0956	·0025	5·75	·00406

* Cubic expansion.

THE PHYSICAL PROPERTIES OF METALS AND ALLOYS.

Messrs. Mather and Platt, Ltd., mechanical, electrical, hydraulic, and fire engineers, of Salford Iron Works, Manchester, have just issued a fifth edition of their valuable price list and pocket-book of tables and useful information. We reproduce the above tables dealing with the physical properties of metals and alloys.

"Great Mogul" was a prodigy in diamonds, the largest of which there is any authentic record in ancient history. Comparison with the "Premier" diamond is, however, impossible, as the "Mogul" disappeared in the sack of Delhi by Nadir Shah in 1739. Attempts have been made to identify the "Orloff" Russian stone as the "Great Mogul" but this is disputed by good authorities. The weight of the "Orloff" in its cut state is only 193 carats, and the "Mogul" must have been a far larger stone. Cutting, of course, reduces the weight of a stone to a considerable extent, and the larger the stone, the more the sacrifice in the cutting operations. A large stone is reduced by quite one half, but even if two thirds of the Premier stone were lost in cutting it would still be by far the largest diamond in the world. The experts, however, have yet to express their opinion on the stone, although it has to be pointed out that other large diamonds recently found on the Premier mine have equalled in quality any that previously found in South Africa, cutting well and possessing great brilliancy.

The Premier Mine, where the big diamond has been discovered, is, as mining men are aware, in the Transvaal, and not on the Kimberley Field, and the discovery has naturally caused a sensation at Johannesburg, where the diamond has been exhibited prior to its shipment to London. It is said to measure 4½ in. by 2½ in. The South African diamonds, as is well known, differ in appearance from those of India and Brazil, being bright without incrustation, and any imperfection being generally visible in the natural state.

The Iron and Steel Institute.

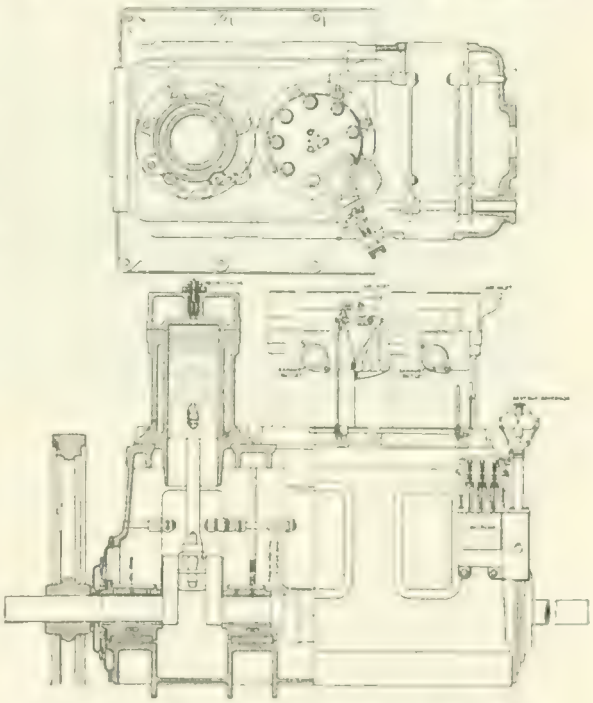
The annual general meeting of the Iron and Steel Institute will be held, by permission, at the Institution of Civil Engineers on Thursday and Friday, May 11th and 12th, 1905. The annual dinner will be held under the presidency of Mr. R. A. Hadfield, in the Grand Hall of the Hotel Cecil on Friday, May 12th. The council will shortly proceed to award Carnegie Research Scholarships, and candidates must apply before February 25th. The awards will be announced at the general meeting.

The autumn meeting, as already stated, will be held in Sheffield on September 25th to 29th, 1905.

Members are invited to participate in the International Congress of Mining, Metallurgy, Mechanics and Applied Geology, to be held at Liège on June 25th to July 1st, 1905, in connection with the International Exhibition. The general secretary of the organising committee is Mr. Henri Dechamps, 16, Quai de l'Université, Liège, and the committee comprises Mr. Jules Magery, Member of the Iron and Steel Institute, president; Professor Alfred Habets, vice-president, president of the mining section; Mr. Adolphe Greiner, Member of the Council of the Iron and Steel Institute, president of the metallurgical section; Professor Herman Hubert, president of the mechanical section, and Professor Max Lohest, president of the section of Applied Geology. The subjects to be dealt with in the metallurgical section comprise coke manufacture; blast furnace practice; influence of titanium, arsenic, and other substances on iron and steel; removal of dust from blast-furnace gas; slag cement; use of poor gas as motive power in rolling-mills; new methods of open-hearth steel manufacture; alloys of steel with chromium, nickel, manganese, vanadium, and tungsten; the forging press and steam hammer; electro-metallurgy and the practical applications of metallography. Visits to the Exhibition and to scientific and industrial establishments will be arranged. Further particulars may be obtained on application to Mr. Bennett H. Brough, secretary.

The Diesel Engine

Concerning the Diesel engine (which is the subject of an article in this issue), Messrs. The Mirrlees Watson Company, Ltd., of Glasgow, write: From seven to eight years ago we made the first Diesel engine constructed in Great Britain. This engine showed that there were certain difficulties to be overcome



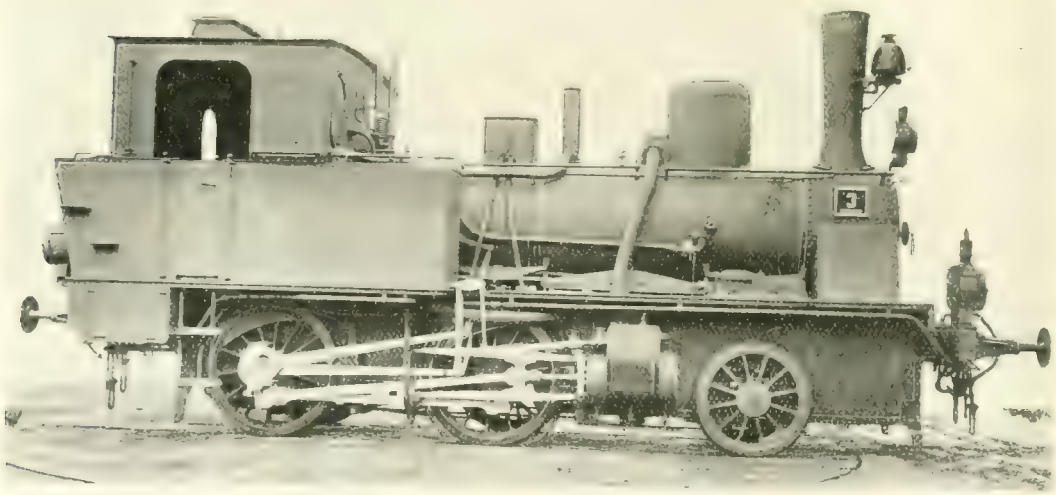
PART SECTION OF 120-H.P. DIESEL ENGINE.

(See page 211.)

before the engine was suitable for general use. During the intervening years we have carried out many experiments and trials, but the past year has seen the development into a completely satisfactory form of this engine. The early troubles of choking of passages and oil sprayers have been quite eliminated; and we now have three engines in operation in our own works for 21, 12, and 9 months respectively, and have thoroughly satisfied ourselves that the earlier troubles have been completely eliminated.

Simplex Conduits.

The Publicity Department of the Simplex Steel Conduit Company have earned the gratitude of wiremen by issuing a very handy and complete booklet, entitled "Simplex Conduit Erection and Wiring," by Mr. L. M. Waterhouse, M.I.E.E., A.M.Inst.C.E. The volume is well illustrated and is handsomely bound. It is admirably adapted for pocket use. A succinct preface sets forth that although steel conduits have become almost universal in present day practice, and are admittedly recognised as the best protection for interior circuits, the subject of conduit wiring has been generally neglected in current technical literature, and it is almost impossible to refer to any work dealing exclusively with this subject. The author's object, therefore, has been to give practical and detailed information concerning the various parts of the Simplex system and their application in practice. The best arrangement and design of circuits, and particulars of up-to-date installation methods have also been included, in order to assist the observant wireman to an intelligent knowledge of how best to meet the varying requirements of conduit installation work, as well as to lead him to an appreciation of the capabilities of the system to carry out each and all of those requirements efficiently and economically. We have also received the firm's "Simplex" price list for 1905, uniformly bound, together with leaflet No. 102 showing important percentage reductions.



TYPE OF SIX-WHEELED FOUR-COUPLED PASSENGER TANK LOCOMOTIVE BUILT BY THE HUMBOLT ENGINEERING WORKS COMPANY FOR TRAFFIC ON THE MOSELLE RAILWAY.

The engine is one of a series built for slow passenger traffic. The steam bell on smoke-stack is used in places where the line runs through unprotected places. The small driving wheels are used to cope with the gradients which in the hilly districts are considerable. Chief dimensions: Diameter of cylinders, 350 mm.; stroke, 550 mm.; diameter of driving wheels, 1,300 mm.; diameter of trailing wheels, 1,050 mm.; total wheel base, 4,500 mm.; steam pressure, 200 lb. per square inch; heating surface of tubes in contact with gases, 57·81 square metres; heating surface of fire-box, 4·87 square metres; total heating surface in contact with gases, 62·68 square metres; total heating surface in contact with water, 69·27 square metres; grate surface, 1,285 square metres; tank capacity, 5·5 cubic metres; coal capacity, 1,600 kilogrammes; weight, light, 26¾ tons; running weight, 36 tons.

THE DIESEL ENGINE IN PRACTICE.

By James D. Macpherson.

Apart from its general reliability the Diesel engine [illegible] and engineers owing to the fact that it consumes cheap stock oil, requiring [illegible] for driving shop machinery, cranes, lifts, pumps, dynamos, etc. Several of the accompanying illustrations have been lent by the Midget Wireless Co., Ltd., [illegible] this form of oil-engine.—Ed

THE Diesel engine operates on what is commonly known as the Otto or four-stroke cycle; that is to say, the cycle of operations in one cylinder is completed in four strokes, as follows:—

First: Downward (or outward, if horizontal) aspiration stroke. In this stroke the piston moves to the outward or bottom end of the cylinder, and at the same time, either by suction or mechanically, the air admission valve opens and allows the cylinder to fill with fresh air at atmospheric pressure. The air is somewhat heated in passage through the valves and port, hence, when the end of the stroke is completed, it is somewhat below atmospheric density and a little higher in temperature, but this difference has little effect on the results obtained.

Secondly: Upward (or inward) stroke compression. During this stroke, the air is compressed to a pressure of 500 lb. per square inch, at which pressure it has sufficient temperature to ignite any form of petroleum (crude or refined) spontaneously. There are no valves open during this stroke, and there is nothing in the cylinder but pure air. The volume of compression space is all embodied in the cylinder head and is first found by calculation. A wooden pattern is then made and whittled until its weight agrees with the calculated volume. Then a plaster-of-Paris core box is made, and this is used to make the cores for all similar heads.

Thirdly: When the piston has reached the top of the compression stroke and the crank is just crossing the dead centre there is the opening of a small needle valve, called the fuel valve (placed on side of cylinder at one end of the port, in which the other valve opens), and a mixture of fuel and compressed air is blown into the cylinder. The quantity of fuel is not all blown in at once; instead, the fuel injection is maintained for a period equal to 10 per cent. of the downward stroke of the piston. It is possible to do this with the small quantity of petroleum necessary by reason of the mixture with compressed air, which increases the volume and thus gives a quantity whose injection can be controlled. The compressed air referred to is compressed by an independent two-stage compressor to 800 lb. per square inch, and cooled before introduction to the food valve. During this period the intention is to maintain the temperature in the cylinder nearly constant, allowing the pressure to fall in conformity with the laws of expansion at constant temperature. It is apparent that this can only be attained at or near the normal load of the engine. With an overload the temperature will rise somewhat and with a light load it must fall, as the quantity of fuel injected is not sufficient to add the heat lost in expansion of the large quantity of air in the cylinder. After the needle valve closes the hot gases expand until the piston has travelled 90 per cent. of its stroke, when the exhaust valve opens, to relieve the pressure before commencement of the next upward or exhaust stroke. The pressure at opening of the exhaust valve for normal load is generally 45 lb. per square inch and the temperature about 700 deg. F.

Fourth v: This fourth and last stroke of the cycle takes place with the piston travelling upward; the exhaust valve opens, and the hot gases rush out through the valve and port. When the piston reaches the top centre the exhaust valve closes, the admission valve begins to open, and the whole series of operations is repeated.

SINGLE-CRANK, SINGLE-CYLINDER TYPE.

In the natural order of things a single-cylinder engine was first built, and its construction and use is confined to all power-driving purposes except electric lighting where the uneven impulse on the crank, affects the light, unless an extremely heavy flywheel is used. Fig. 3 shows the crank effort on a 16 by 24 single-cylinder engine. Fig. 4 shows the crank effort, velocity curve, and displacement of the crank-pin on a 12 by 18 triple-cylinder engine. Fig. 5 shows the same curves for 16 by 24 six-cylinder engine.

With the single-cylinder engine the standard flywheels furnished for ordinary factory work would be used. With the three-cylinder engine, in fig. 4, a somewhat heavier flywheel was used to drive 60-cycle inductor machines on electric lighting, while with the six-cylinder engine a very heavy wheel was used, as the work was that of a suburban trolley line.

DOUBLE-CRANK ENGINES.

When a four-cycle engine is made of the double-cylinder type with two cranks, the customary method is to have the cranks run together, or 360 deg. apart, causing the shaft to receive an impulse every revolution first one cylinder and then the other receiving an ignition. This type runs very well, but for manufacturing and other reasons, another cylinder is added, and the three-cylinder engine is more nearly the accepted standard, while with the constantly increasing demand for larger engines, the four cylinder unit must be reached, and at at present, to meet requirements for a 500 h.p. unit, two three-cylinder 250-h.p. engines are coupled direct to 300 kw. alternating current generator between them.

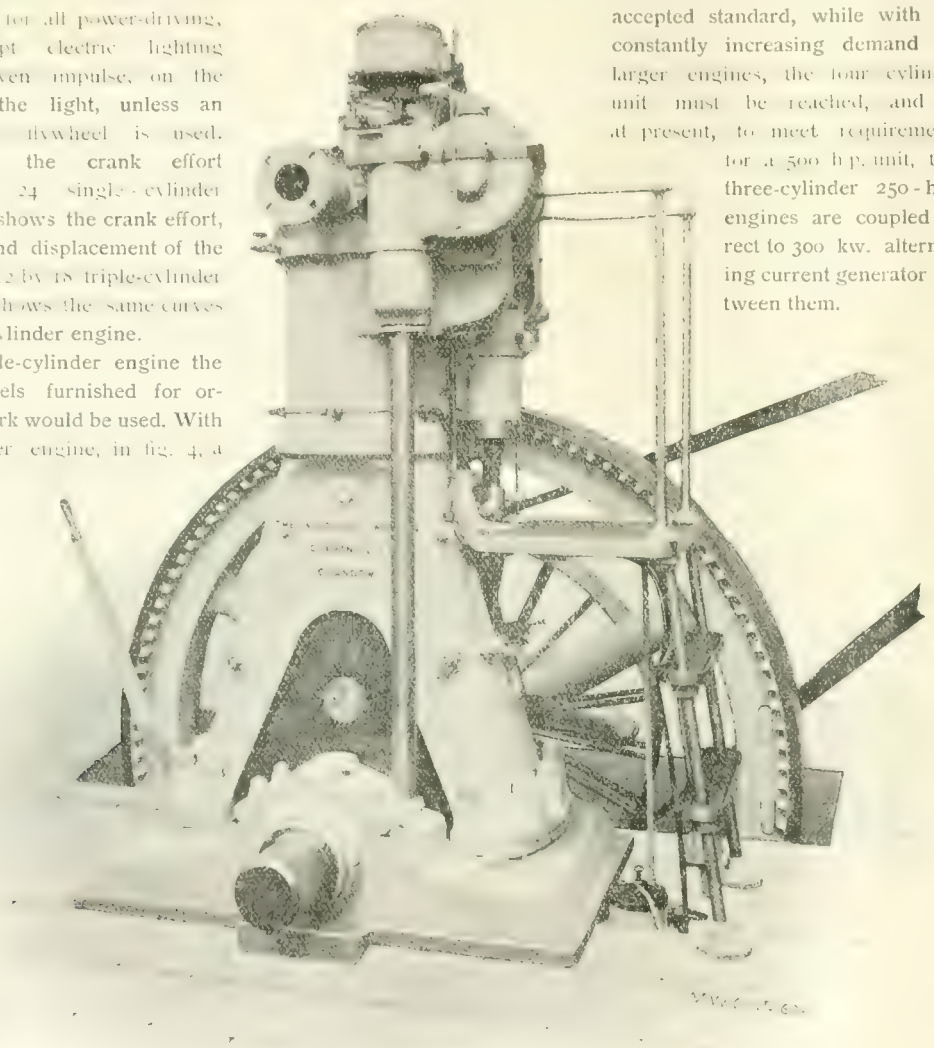


FIG. 1. SINGLE CYLINDER 35 B.H.P. DIESEL ENGINE,
As installed at the Scotland Street Works of the Mirrlees Watson Company, Ltd., Glasgow.

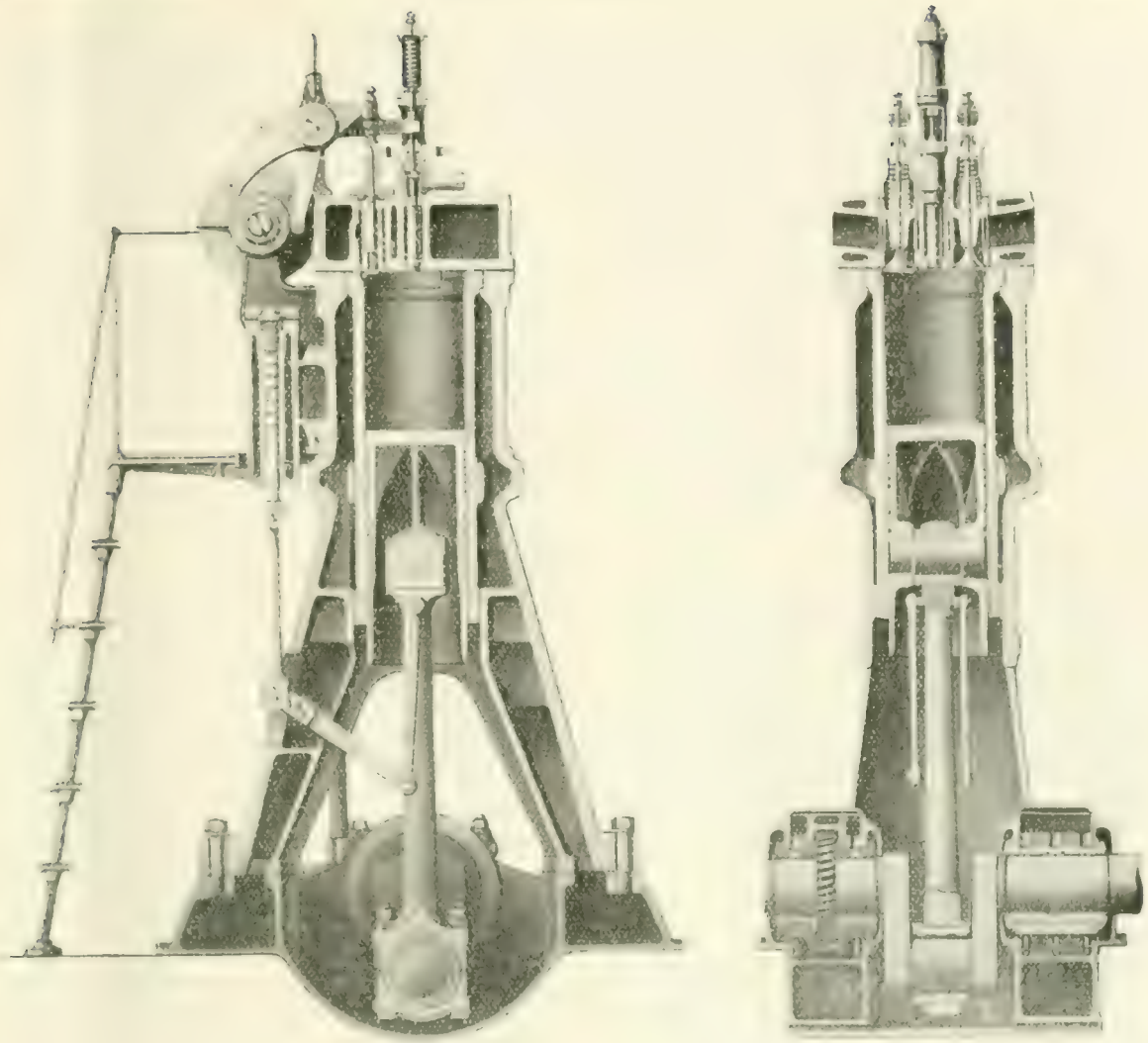


FIG. 2. SECTIONAL ARRANGEMENT OF THE DIESEL ENGINE.

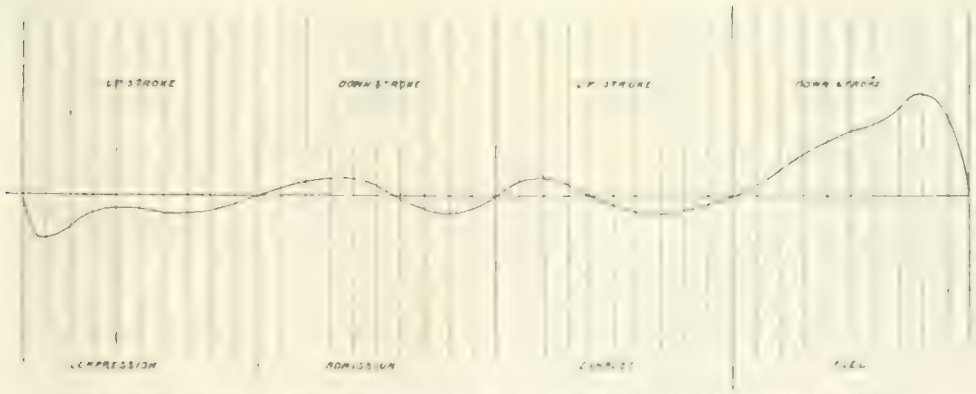


FIG. 3. SHOWING CRANK EFFORT ON A 10 BY 24 SINGLE-CYLINDER ENGINE.

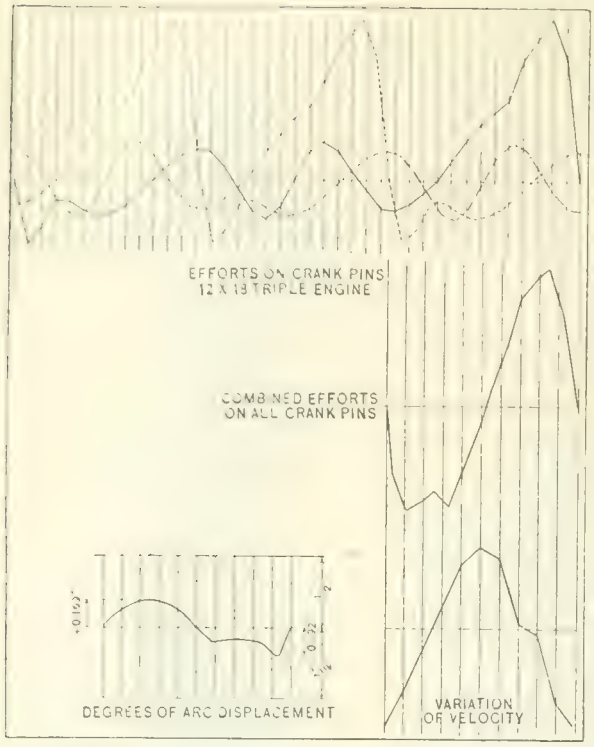


Fig. 4. Crank effort, velocity, curve, and displacement of the crank pin on a 12 by 18 triple cylinder engine.

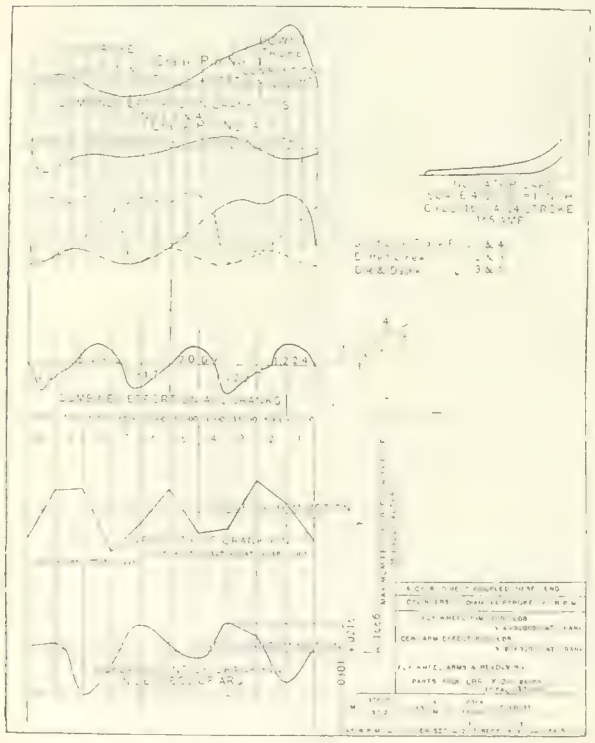


Fig. 5. Curves for a 16 by 24 six-cylinder engine.

Small engines have been built to operate on what is known as the two-cycle principle of operation, while engines operating on the four-cycle principle, but double-acting, are projected. These being aside from the direct issue of this article, it will not be treated of at present.

DESIGN AND CONSTRUCTION.

From the section through the centre of the cylinder it will be seen that the piston is a long trunk proportioned approximately with the length, $2\frac{1}{3}$ times the diameter. This gives a minimum of bearing pressure, and wear is almost eliminated. There are four cast-iron rings fitted in grooves at the top end, and the top end of the piston is tapered at least $\frac{1}{32}$-inch smaller in diameter, so as not to seize when expanded by the high temperature. The connecting-rods are solid steel forgings, the boxes also being of steel, machined out and lined with babbit at the lower end, and with a brass bushing at the upper end The main bearings are supported on cast-iron wedges and also adjustable sideways.

There are numerous examples where these engines are operating on variable load; one in particular at Peoria, Ill., where the load is supplied by two elevators, there being only enough lighting current used to give a load of 5 amperes. The elevators are used intermittently all day, so that the load is constantly varying from a half kilowatt to 40 and 50, while the voltage is kept within a variation of 4 volts, the generator is over-compounded and assists in this result, but even with this load the results are remarkable.

It will be noticed that in addition to the splash lubrication in the crank case, there is an oil chamber and an oil ring provided in the main bearings. This is a safeguard against the oil becoming too low in the crank case, where it might be splashed sufficiently to lubricate the connecting rod and piston, while none would reach the main bearings.

The lower temperature of the Diesel engine gives the parts subjected to heat a much longer life than in engines of the explosive type. The valves do not burn out, no admission or exhaust valve having yet been replaced, nor have any shown any bad effects from heat. There is no deposit in the cylinder or on the valves, and they do not need to be withdrawn for examination.

From a paper contributed to the Engineers' Club of Philadelphia

STEEL FOR THE MANUFACTURE OF ARTILLERY.

By Colonel Cubillo (Spanish Royal Artillery).

V.—WATERVLIET ARSENAL.

(Continued from page 18).

WATERVLIET ARSENAL, situated in West Troy, near Albany, N.Y., was decided upon by the Mixed Committee as the workshop for the manufacture of artillery for the army. It is in touch with three or four railway lines, the Hudson river, the Erie canal, and New York. Four hours' journey by rail and eight by water offer all the advantages of a city of importance for the acquisition of materials, recruiting of workmen and despatch of goods abroad.

The gun shop has three bays, the central one being much higher than the two lateral bays. In the central bay are the boring, rifling, turning and chambering machines. The lathes, boring and rifling machines have been supplied by the Niles-Bement Pond Company. The same care is exercised at Watervliet as at Washington for the prevention of accidents.

The Arsenal has a tool room, which forms part of the large artillery workshop, where the special tools are manufactured and repaired. This room is very completely equipped with gauges, tools, and measuring instruments of precision, supplied by the Pratt and Whitney Co.

There is another shop, devoted to the 5-in. pieces and guns, where, at the time of our visit, the 75-millimetres Vickers-Maxim model mountain guns, 9-centimetre field howitzers, siege guns of 127 millimetres, 177·8-millimetre howitzers, and rapid-fire guns of 127 millimetres were made.

Last year the coast-gun factory turned out twenty-nine pieces of the 1897 model 150-millimetre guns, and had in hand forty-six of the same calibre, model 1900. Twelve guns of 25 centimetres, model 1895, were being constructed and the tubes and sleeves for six others of the 1900 model had been received.

An experimental 25-centimetre howitzer had been finished and sent to the Sandy Hook grounds for testing. During the year the arsenal had completed of the model 1895 30·5-centimetre guns eleven and had eighteen in hand. Of the 1900 model the experimental gun had been finished and eleven were being completed. Lastly, of the forty, 1890 model, howitzers of this calibre twenty-nine were finished with the exception of the firing mechanism.

The details of the model 1897 and 1900 guns, made for the army, are as follows :—

	Calibre m	Length Calibre	Weight Kg	Initial Velocity Metre	Pressure cm	
Model 1897	15	45	45	795	23	Krupp plates and tipped
	25	35	260	701	4[illegible]	
	30·5	35	453	[illegible]	30[illegible]	
Model 1900	15	50	45	915	28	Prochetile
	25	40	260	780	30	
	30·5	40	453	780	62	

Watervliet has a system of manufacture similar to all artillery factories. That in vogue at present is composed of a central tube, and the necessary sleeves and hoops. They have adopted as the elastic limit for their calculations the minimum admitted for the reception of the steel, taking into account the deformation produced by the elastic strain.

In pieces of 20, 25 and 30 centimetres a minimum tangential resistance of 3,700 kilogrammes per square centimetre is obtained in the chamber, and the average normal pressure of these guns does not exceed 2,600 to 2,700, or, approximately 73 per cent. of the tangential elastic resistance. The American officials estimate that the highest pressure the guns I have referred to are capable of resisting is 4,916 kilogrammes per square centimetre, judging by experiments at Sandy Hook, where a gun of this class burst under a slightly higher pressure when using a too powerful explosive. A 15-centimetre gun will resist a pressure of 6,040 kilogrammes per square centimetre without worse damage than the wedging of the lock.

(To be continued.)

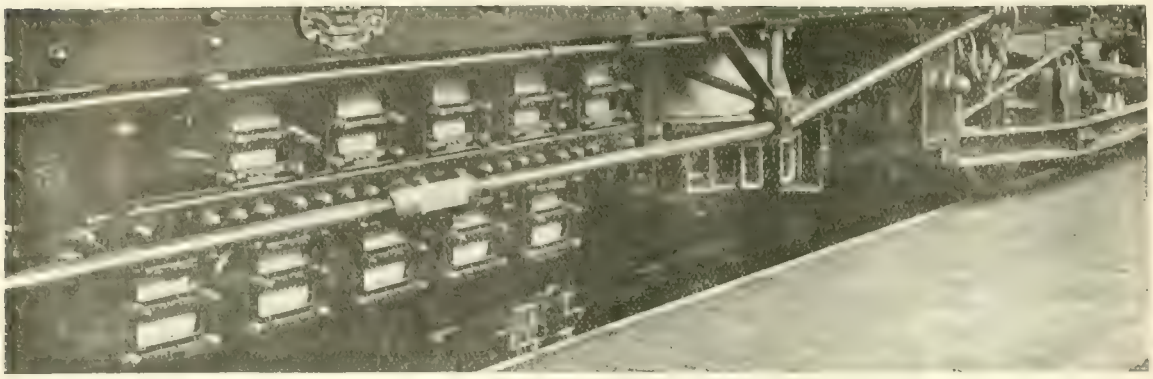


FIG. 1. SHOWING TURRET CONTROLLER IN POSITION ON CAR.

The Electrification of the Metropolitan Railway.

(*Continued from page 180.*)

ALL the electric trains on the Metropolitan Railway will be operated on the multiple unit system. The Westinghouse unit switch system of control consists essentially of two parts, the turret controller carried under the body of the motor-car, and the master controller placed in the motor-man's cab. The former takes its name from its shape, and is a wonderfully ingenious combination of magnetic blow-out switches and pneumatic cylinders controlling them. Grouped around the centre are 15 unit switches or circuit breakers, each of which is operated by a separate pneumatic cylinder, working against a powerful spring. The latter tends to open the switch, which can only remain closed so long as the air pressure is in the cylinder. The magnetic blow-out arrangement consists only of one coil that affects all the switches alike. It is marked B in fig. 2 and fig. 3 shows its trough-shaped pole-pieces, which point alternately up and down, the former being fixed to the main casting and the latter to a special spider, or extension of the magnet core, at the bottom. The switch contacts are each surrounded by a vulcabeston box open at the front, and are placed in the direct path of the magnetic field, as shown in fig. 3. The *raison d'etre* of this single blow-out coil is that it makes it possible to obtain a much stronger field with less wiring and weight of material than with the arrangement of small separate coils.

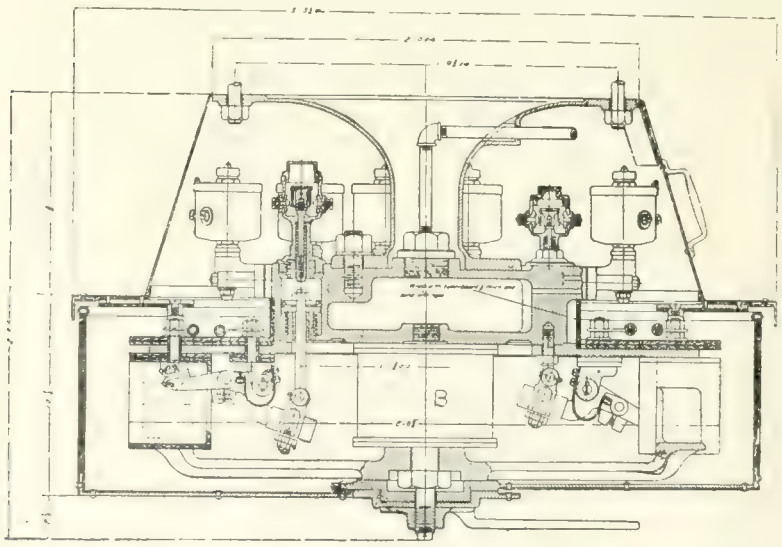


FIG. 2. SECTION OF TURRET CONTROLLER.

The air cylinders placed in a circle above the switches, are controlled by magnetically-operated needle valves, which, when open, allow compressed air to pass from the central chamber where it is stored to the cylinder closing the switch attached to it. The pipe projecting from the centre of the turret controller, figs. 2 and 3, conveys compressed air to the storage space.

The master controller shown open in fig. 4 and in position in fig. 5 is remarkable for its small size and compactness. It operates the above-mentioned

needle air valves of the turret controller by aid of a 14 volt current taken from a small storage battery on the car. As will be seen it has five notches for both forward and backward running in addition to the "off" or neutral point. The movement of the controller handle to the first step sets the emergency brake valve; the second sets the reverser, a piece of apparatus for controlling the direction in which the car is run, and puts on the main supply current; the third or shunting notch connects the motors in series with all resistance in; the fourth brings the automatic accelerator into play which closes the switches of the turret controller in their right order unless checked by what is termed the limit switch; and the fifth opening all the pneumatic switches that have been closed and simultaneously throwing in others connects the motors in the first parallel stage with resistance in circuit.

To make the matter clear some further description of the auxiliary apparatus mentioned above is necessary. The reverser shown in fig. 6 is pneumatically operated and upon it as stated depends the direction in which the car runs. The movement of the controller to the second notch magnetically actuates its valves shown on the right of the figure and admits air to the cylinders that move the switch. The limit switch accelerator which is a very important part of the apparatus commences operation at the fourth step and automatically closes the turret controller switches one after the other up to the eighth resistance or last series point.

After the movement of the master controller to the fifth notch has effected the change from series to parallel the automatic accelerator again comes into play, and limits the rate at which the necessary changes in connections are made to attain full speed.

The overload and no voltage relay shown in fig. 7 is in electrical connection with the actuating magnet of one of the pneumatic cylinders of the turret controller which operates the main circuit breaker. To prevent damage from a resumption of supply after an interruption, such as a break in the third rail or persistent bad contact in the collecting shoes, the no voltage part of this device returns the controller to a position in which some considerable amount of resistance is in the circuit, allowing it to be gradually and automatically cut out when the current comes on again. Sudden interruption and resumption of supply such as occurs when the collecting shoes leave parts of crossings to run over the rails at a lower [illegible] to avoid, for obvious reasons, the

Three of the most important points in the control equipment of these cars that are ingenious, and have [illegible]

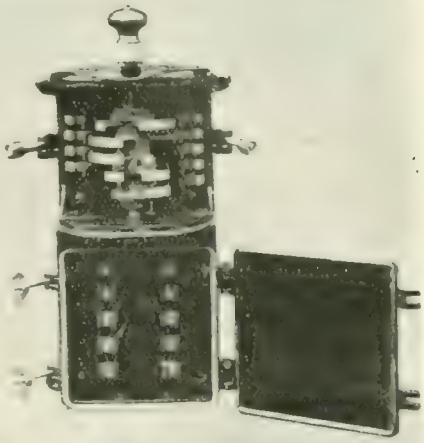


FIG. 3. TURRET CONTROLLER.
FIG. 4. MASTER CONTROLLER.
FIG. 5. MASTER CONTROLLER IN POSITION.

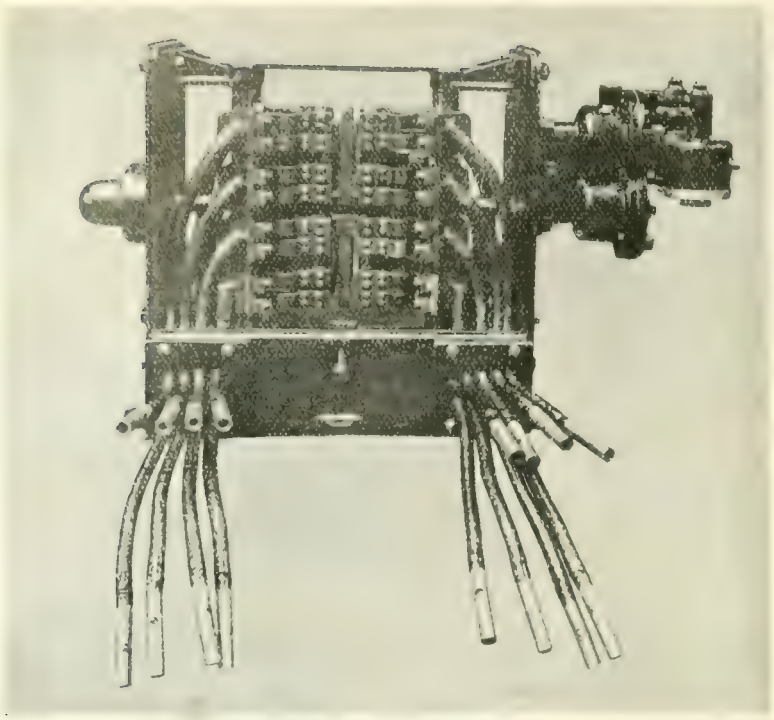


FIG. 6. REVERSER.

has been recognised that through accident or sudden illness, the motor-man may leave hold of the controller-handle, in which case, especially under the latter circumstance, grave consequences may ensue. This is provided for by means of a strong spring action which, when the handle is released, returns it to the neutral position, interrupting *en passant* the circuit of an electro-magnet attached to the air brake. This opens a valve in the main pipe of the system, allowing the air to escape, and the brakes to be immediately applied over the full length of the train.

In ordinary reversing of the train, this arrangement does not operate provided the handle is passed quickly over the neutral points.

The second safeguard is that which prevents any harm being done to the motors if the operator moves the controller-handle rapidly over to the full parallel position. In such case, the speed of working of the turret-controller does not increase, and the various connections passing from first series to full parallel are made automatically at the right pace. This reduction of the human element to a very low value results not only in greater safety and comfort to passengers, but in considerable economy in power consumption amounting to as much as 10 or 15 per cent. over that obtained by ordinary hand operated methods.

The third provision is a system of interlocking between the control equipment and the power brakes whereby the controllers throughout the entire train are opened automatically when the brakes are applied, no matter in what position the driver may have or continue to hold the master switch handle.

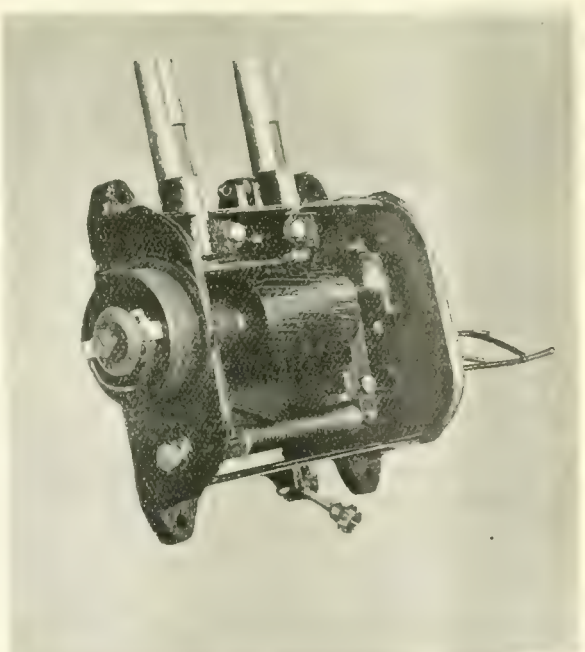


FIG. 7. OVERLOAD AND NO VOLTAGE RELAY.

AT the half yearly meeting of the Metropolitan Railway Company, Sir C. McLaren, M.P., referred to the trains which are already running between Baker Street Station and Uxbridge, through Harrow, by the new method of traction. They were, he said, gradually increasing the number of electric trains into and out of Baker Street, and hoped shortly to be able to dispense with steam entirely on that section. So far as the Inner Circle service was concerned, they hoped very soon to run some electric trains on that section also

NAVAL NOTES.

WEEKLY NOTES ON NAVAL PROGRESS IN CONSTRUCTION AND ARMAMENT.

(BY OUR NAVAL CORRESPONDENT.)

GREAT BRITAIN.

WHEN Lord Selborne first gave publicity to the new scheme for the distribution and mobilisation of the British War Fleets, occasion was taken to mention that the Naval manœuvres of 1905 and 1906 would be devoted to the testing of the new arrangements. And since it was obvious that such a test must be world-wide in its operations, and that to be in any measure successful must include all the fleets and squadrons, no surprise has been expressed that the "general idea" of the hypothetical strained relations which are to form the basis of the ships' movements in 1905 has already been published. Time will be required for the Commanders-in-Chief on the various stations to interchange communications with a view to concerted action. This first series of movements being carried out on the hypothesis that relations with some foreign Power or Powers are strained, will not be of a warlike nature. Indeed it will be the tactful and diplomatic officers who will gain the most distinction in the manœuvres.

No more launches of large vessels have taken place, but one more destroyer, the *Wear*, was put into the water on January 21st, by Palmers' Company, and two submarines of the "B" type were launched at Barrow on the 24th of that month. The cruiser *Diamond* has been completed by Messrs. Cammell, Laird and Co., and will be commissioned next week for service with the Particular Service Squadron, being permanently stationed in the West Indies. The *Sapphire*, a sister-ship, has been allocated for duties with the torpedo and submarine flotillas, flying the flag of Rear-Admiral A. L. Winsloe C.M.G. The *[illegible]* destroyer has been completed by Thornycroft's and passed into the reserve with a nucleus crew at Devonport. The armoured cruiser *Argyll* will commence her trials at the end of this month.

UNITED STATES.

The bids for the battleship *New Hampshire* and the armoured cruisers *Montana* and *North Carolina* are unprecedently low, being eleven per cent. below the aggregate lowest bids for three similar ships which were put out to contract twelve months ago.

The Midvale Steel Company of Philadelphia has commenced delivery of armour plates for the vessels authorised by Congress in 1903, the contract for which they captured from the Carnegie Steel Company and the Bethlehem Steel Company last year, after these two firms had enjoyed a monopoly of the supply for ten years.

Progress with the vessels in hand continues steady, the first six on the battleship list having gone up two per cent. in their degrees of completion during the past month. The *Vermont*, *Kansas*, *Minnesota*, and *Mississippi*, all went up four per cent. during December, and of the armored cruisers four are now within 7 per cent. of completion. It is expected that in all twenty-one vessels of various types will be completed and commissioned during the coming year, including five battleships, four armoured cruisers, and two protected cruisers, with small craft. The dates announced for the commissioning of the larger vessels are as follows:—

January 30.—*West Virginia* armoured cruiser.
February 13th.—*Pennsylvania*, armoured cruiser.
March 12th.—*Maryland*, armoured cruiser.
October 15th.—*Virginia*, battleship.
October 15th.—*Nebraska*, battleship
November 12th.—*Rhode Island*, battleship.
December 3rd.—*New Jersey*, battleship.
December 10th.—*California*, armoured cruiser.
December 12th.—*Georgia*, battleship.

SWEDEN.

The Naval programme of 1901 which was to have been completed by next year has fallen so much in arrears that an increased grant has been asked for for 1905, in order that the programme may be completed in 1907. The following is the proposed allotment of this grant. The sums asked for are as follow. For completion, the armoured cruiser *[illegible]*, £14,300; first instalment new armoured of *[illegible]* type, £123,000 total cost £385,700); completion of torpedo-boat destroyer, £33,400; two torpedo-boat destroyers, £133,600; first instalment two large torpedo-boats, £55,[illegible]; nine small torpedo-boats, £99,100; training vessel, £11,600; reconstruction of *[illegible]*, £29,500; ditto of *Hedin*, *Biorn*, and *[illegible]*, £28,050; three guard boats, £14,100.

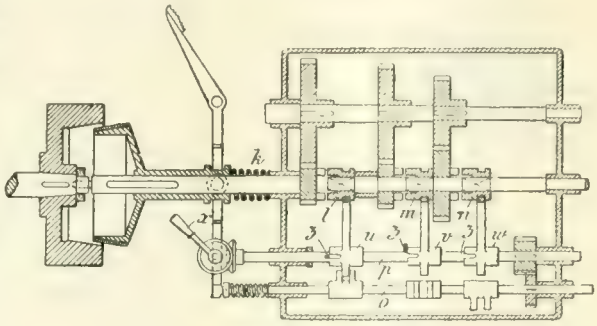
AUTOMOBILE NOTES.

The Palace Show.

The first of the series of London Automobile Exhibitions was opened on Friday at the Crystal Palace. The show will remain open until February 4th, and in connection therewith competitions are being organised relating to motor accessories and non-slipping contrivances. It suffers by comparison with last year's show, but is representative of some eighty exhibitors.

Soames Change Speed Gear.

This system was described in the course of a paper contributed by Mr. Frank Little to the proceedings of the North-East Coast Institution of Engineers and Shipbuilders. As will be seen from the diagram, the gear wheels are always in mesh, and are locked to the shaft, as required, by interlocking jaw clutches, the main clutch being shown on the left. When the clutch pedal is pressed down (the position shown in the diagram), it first releases the main clutch; on being further depressed, it presses the cam shaft, O, against its spring, unclutching the wheel which happens to be engaged, and allows the selection of another gear wheel, by turning the change speed handle, X. This change speed handle, X, turns the rod, P, through the bevel wheels, and this rod turns



SOAMES CHANGE SPEED GEAR.

the shaft, O, by means of the gear wheels shown on the right. This causes one of the three double fingers, which are fixed on the shaft, O, at different angles to one another, to pick up the tail of one of the sliding forks, U, V or W. When the pedal is released and rises, the spring presses the shaft, O, to the left and, through the medium of one of the forks, U, V, W, which has been picked up, slides its jaw clutch, L, M or N, to the left, thus clutching its gear wheel to the shaft.

In the diagram the fork, U is shown to be picked up, and as soon as the pedal is released it will make the jaw clutch, L, engage with the shaft, K, thus giving a direct drive, this being the drive on top speed. The shaft, O, when the main clutch is in, is locked out so that the jaw clutch in use is held in position by means of a trigger (which is not shown) and is not dependent on the spring. The pins and slots, Z, on the rod, P, prevent the handle, X, from being moved, except when the pedal is fully depressed, and also prevent any but the selected gear from being engaged, the handle and all gears not in use being definitely locked except when the pedal is depressed. In order to avoid complicating the diagram, the reverse has not been shown, neither does the positive locking arrangement appear. The system is of course applicable to more than the three speeds and is arranged for either gear driving with a live back axle or for chain driving.

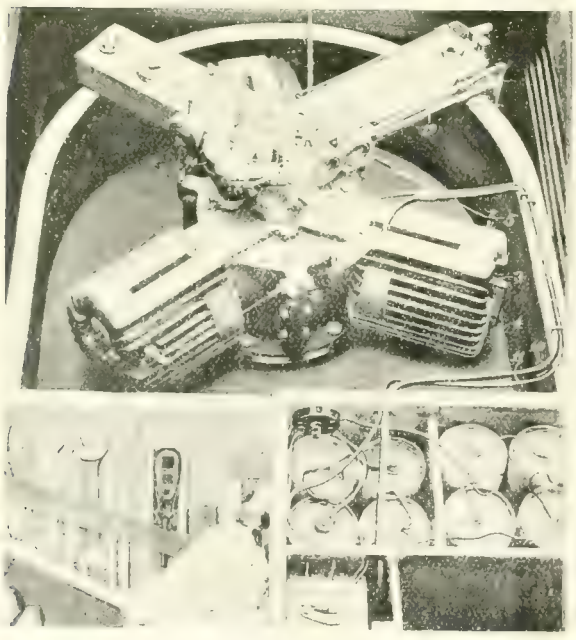


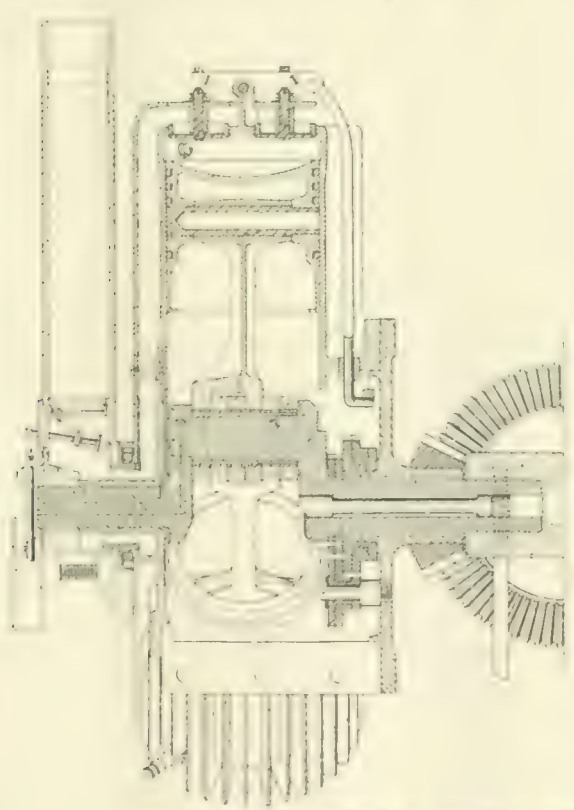
FIG. 1. NEW GASOLINE MOTOR BY THE ADAMS COMPANY.

A New Gasoline Motor

The Argus Company of Dubuque, Ia., favors us with the accompanying illustrations of a revolving cylinder air-cooled gasoline motor upon which has been assigned such a view to securing certain results as to balance, light weight, wide range of speeds and power and air-cooling qualities. This reverses the ordinary practice in that the engine cylinders revolve and the crank shaft is stationary. Three units, each being a complete cylinder with cylinder base, are one half of a central crank case cast in one piece. Each projection [illegible] bolted to a cast iron bottom cast steel flange which has bronze bushings forming bearings around the vertical stationary crank shaft. This forms the revolving unit and the flywheel of the motor. The three pistons are connected to a single crank wrist pin of very large proportions by bronze pitmans. The pitmans with the pistons at their outer end swing around the stationary wrist pin. The wrist pin being eccentric with the axis of the revolving cylinder unit causes the pistons to reciprocate back and forth in the cylinders at each revolution of the cylinders. This does not change or stop and return the masses of pistons at each dead center as with an ordinary engine. It is therefore [illegible] to a very accurate mechanical balance. The action of the exploding charge is practically the same in this engine as in the ordinary kind.

Air cooling is accomplished by the cylinder revolving at a speed [illegible] drawing in the air at the center and expelling it with great rapidity at the ends of the cylinders. The cylinders are provided with longitudinal ribs which add a large radiating surface.

The speed of the motor is controlled entirely by its [illegible] compression system. The carburetor is entirely automatic. Gasoline is pumped through the upper pipe into a constant level reservoir which is a small casting covered with a watch crystal enabling the gasoline to be seen. The surplus gasoline flows back into the pump well through the lower tube. The spark is regulated automatically by a device employing a centrifugal governor which not only advances the spark when the speed of the engine increases, but also increases the length of the contact of the primary circuit. A contact of the primary circuit for ¼ of a revolution of the engine gives sufficient time for the spark coil to become saturated and gives a good spark when the engine is running 150 revolutions or less. This contact is automatically increased to about ½ of a revolution of the engine when running at 900 revolutions per minute.



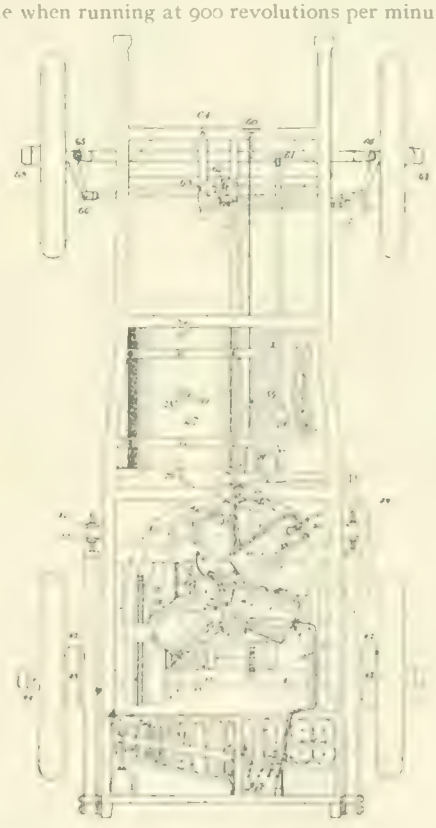


FIG. 2. ARRANGEMENT OF GASOLINE MOTOR WITH REVOLVING CYLINDERS.

RUNNING-SHED NOTES.

By J. C. R. Adams.

I PURPOSE, under this title, to briefly describe what may be called the education of a steam engine, the various adjustments and attentions which are needed before a new engine is fitted to take its place as a useful and economical source of motive power.

There are some items of knowledge which are the common property of the workmen actually engaged in the construction of, or in attendance upon, certain engines or machinery, which are not to be found in printed books, and seldom form the subject of papers addressed to technical audiencies. But in discussing the processes of the workshop and the methods adopted by the man who actually carries out the ideas of others, we sometimes tap a vein of human insight and practical wisdom which is not beneath the attention of the most advanced student of mechanical science.

Now there is probably no greater nuisance known to users of steam power than the tendency manifested by some one or other of the bearings to "run hot," as it is termed, in spite of the possible fact that the bearing is amply large enough for its work, is not screwed up too tightly, and that the lubricant is of excellent quality and is supplied in quantity obviously more than sufficient.

Of course, if the bearing is defective in any of these four points, the remedy is indicated without going further, but sometimes, for no assignable cause within the knowledge of the steam-user, the bearing cannot be kept cool and much inconvenience is caused thereby.

The remedy is to ensure that a continuous, and unbroken film of oil is maintained between the working surfaces of the shaft or "journal," and its encircling bearing or "brass." If this film be preserved obviously neither heating nor destructive wear can take place. The only problem is, how to preserve it?

Imagine for a moment instead of the film of oil, a series of small cylindrical rollers interposed between the journal and the brass. If the shaft be now revolved the ring of rollers will rotate, as a whole, around the shaft, at the speed of their own centres, which is of course midway between the peripheral speed of the shaft and the stationary brass, with both of which the rollers are in surface contact. The film of oil does exactly the same thing—it strikes the mean between the fixed and revolving surfaces, and it will continue to do this unless the pressure is sufficient to squeeze it out from between them, or, unless it be scraped or peeled off the shaft by the sharp edge of the brass, when of course, contact ensues between the two metallic surfaces and heating begins.

Again, a bearing in halves, when heated, does not expand away from the revolving journal, and so tend to free itself. On the contrary, it closes upon the shaft and so the heating proceeds in a compound ratio. A half-brass which has been heated, moreover, does not regain its original diameter, but remains, even after being cooled, perceptibly tighter upon the shaft, and consequently a looser fit between the jaws of the plummer-block than it was originally.

The remedy for this is to scrape away the metal of the half brass from the edges downwards so that only about one-fourth of the circumference, or ·7854 × diameter is in contact with the shaft. By this means the oil is led in instead of being peeled off, and the first step towards the maintenance of the continuous film is taken.

Some very interesting experiments have been made by Mr. Dewrance, bearing upon this subject, the results, shortly stated, being that

for effective lubrication the oil must be fed in at the point of least pressure, and that a gradually decreasing space must exist between the surface of the brass, and its shaft, or journal, by which the oil may be, literally, induced to enter the actual bearing surface.

Heron, he only demonstrates the theory of the well-known practice of "easing away" the brasses at the sides. From this we deduce the fact that in bearings such as those of the connecting-rods of horizontal engines, when the brasses are divided vertically, and the lubrication introduced at the top, no oil-channels are needed; while in the main bearings of the same engine the oil should be introduced at the sides of the bearing, being brought thereto either, as he suggests, by external oil-pipes, or by internal grooves or channels cut into the internal surface of the upper bearing.

Heavy shafts, such as the main bearings of large horizontal or vertical engines, should be fitted with oil pumps for continuous feeding, while for quick revolution engines, forced lubrication under pressure possesses such important advantages that its use is becoming almost exclusively adopted for engines of any size. But whatever system be adopted the entrance of the oil at the point of least pressure is desirable.

There is one more important condition to be observed. In bearings which are fitted to work well when hot it must not be forgotten that a little end play is necessary. The slightest pressure endwise upon such a bearing is sufficient to set it heating, and the expansion thus produced aggravates the evil, and would soon bring the engine to a standstill, if not observed in time. These are the points requiring observation and correction in the case of new engines, so far as the bearings are concerned, and it is thought that the hints which experience in the testing and running of new engines have suggested to the author may be of service to users of engines whose bearings are inclined to give trouble.

OBITUARY.

We regret to see in the Continental journals the announcement of the death of Joseph Chaudron, the veteran Belgian mining engineer, at the age of 82. He was educated at the Liége School of Mines, and in 1845 entered the Belgian Government service, which he quitted ten years later to devote his attention, in connection with the German boremaster, Carl Gotthelf Kind, to perfecting the method of boring shafts now throughout the world is known by their names. Under Chaudron's direction from 1854 to the present time, upwards of 80 shafts have, in England, Belgium, France and Germany, been successfully bored to depths of several hundred yards through quicksands, and mineral resources to the value of many millions of pounds thereby rendered available. The latest application of the Kind-Chaudron method is now in progress at the Dover Colliery.

There is general regret at the news of Mr. Charles Horsley's death. He was associated with some famous engineering works, notably the tubular bridge over the Menai Straits, but was probably best known as consulting engineer and London representative to Messrs. Cockerill and Co., of Seraing. Mr. Horsley was the inventor of a gas-exhauster and Exhibitor, and was President of the Society of Engineers and a member of the Institution of Civil Engineers.

Mr. John Howard Richardson, also deathly reported in October, was the superintendent of the London Brighton and South Coast Railway for twenty years.

Mr. [illegible] Smedley, at [illegible] Lancashire, took [illegible] ago, was a well-known member of the Mechanical Engineers. He was the partner established the Lever Timepieces, and many years ago and Mr. Alfred Smedley [illegible] active engineering part in the [illegible] with the [illegible]. He possessed [illegible] and [illegible].

Our American contemporaries report the death of Mr. [illegible] Porter, [illegible] well-known engineering [illegible] and [illegible] Mr. Porter in Philadelphia [illegible] He was [illegible] books upon those subjects.

[illegible] Mr. [illegible] Power, [illegible] Power and Co., Limited, [illegible] Mr. Power [illegible] Power [illegible] valves [illegible] works.

[illegible] Mr. Benjamin Dowry, [illegible] Limited, [illegible] Mr. Dowry [illegible] Mr. [illegible] Dowry [illegible] and [illegible].

OUR WEEKLY BIOGRAPHY.

MR. GEORGE JACKSON CHURCHWARD, M.Inst.C.E., M.I.Mech.E.

READERS of our "Locomotive Notes" will be quite familiar with the name of Mr. G. J. Churchward, the chief of the mechanical engineering department of the Great Western Railway. Born in 1857 at Stoke Gabriel, Devon, he gave evidence, when quite young, of a strong bias for matters pertaining to mechanics, and at the conclusion of his primary education he decided upon becoming a mechanical engineer; he was therefore articled to Mr. John Wright, locomotive superintendent of the South Devon and Cornwall Railways, and under this expert's direction, he acquired a sound knowledge of the profession which he has followed with noteworthy success.

Mr. Churchward went to Swindon in 1876, about the time when the amalgamation was effected between the South Devon and Cornwall lines and the Great Western Railway. His first appointment was in the drawing office, and subsequently he became inspector of materials. In 1881 he was selected for the position of assistant to Mr. James Holden, the manager of the carriage and wagon works, and on Mr. Holden's retirement from the post, he was appointed his successor. A few years later he undertook the management of the locomotive works, and some time afterwards he was again promoted, and made first assistant to Mr. William Dean, who was then the head of the mechanical engineering department. In 1902, Mr. Dean retired from the service of the Great Western Railway Company and Mr. Churchward was appointed chief, which position he now holds.

From "G. W. R. Magazine."

MR. G. JACKSON CHURCHWARD, M.INST.C.E., M.I.M.E.

When Mr. Churchward first became associated with the Great Western, the Company's rolling stock was as follows :—

Locomotives, 1,471 ; Passenger vehicles, 4,177 ; Goods vehicles, 32,393.

A remarkable increase is shown at the present day, the stock now amounting to :—

Locomotives, 2,270 ; Passenger vehicles, 7,102 ; Goods vehicles, 63,086.

During recent years the steadily increasing weight of express passenger trains, together with the keen competition to secure through traffic, has led Mr. Churchward to design and construct some powerful locomotives, details of which have already appeared in PAGE'S WEEKLY.

Mr. Churchward is a member of the Institution of Civil Engineers, and of the Institution of Mechanical Engineers ; in 1900 he was elected first Mayor of the Borough of Swindon.

Japanese Field and Mountain Artillery.

The tube of the gun illustrated on page 244 consists of the tube *A*, the jacket *B*, the trunnion band *C* carrying the trunnions which are lengthened out on either side and each serve also as the axle of the wheel, the locking ring *D*, and the front ring *E* which holds the jacket to the tube. The gun is of forged steel and is painted a smut colour.

At the breech end (fig. 2) on the under side are two projections *H* between which the arm *J* of the carrier is pivoted by the pin *G*. On top of the breech is the sight *K* for the pointing gear and on the right side a tubular projection *F*, perpendicular to the axis of the gun, which holds the sight in direct fire or the elevation plate in indirect fire.

The breech mechanism is of the interrupted screw type and opens downwards. It consists of the carrier *L*, the breech block with its threaded sectors *M'*, the angular operating lever *MNQ*, the extractor and firing mechanism. The carrier as above stated is hinged to the breech of the gun on the lower side. The cylindrical breech block has its threads cut away over one quarter of the circumference in two places, likewise the breech housing of the tube, so that when the breech block is pushed in, a quarter turn locks it. The breech block is housed in the carrier and can be rotated in the latter one quarter of a revolution. It is bored out axially to receive the firing mechanism. Towards the top of the carrier is the operating lever *MNQ*, which turns about *M*. It has a horizontal arm *NM* and a short vertical arm *MQ*, the short arm carries a stud which engages in the slot *Q* in the breech block, and in opening and closing the breech serves to rotate the breech block the required amount. The operation of opening the breech is then evident. The operating lever is raised until the arm *NM* is vertical, whereby the short arm becomes horizontal and the breech block is turned through one quarter of a revolution. The slot *Q* is then in the dotted position *Q'* (fig. 2), the screw threads of the block are disengaged from the female threads of the breech housing, and the block is locked to the carrier by means of the locking bolt *R*. The carrier, together with the block, is then pulled down to the rear until it comes into the horizontal position, in which it is held by a suitable support (dotted lines fig. 3). Closing the breech is performed in the inverse order.

The firing mechanism consists of the firing pin with its striker, the main spring, another small spring, and the trigger *S*. The two springs are assembled one around the other; the main spring is compressed and the firing pin guided by cross-pin through it. If the breech block is not fully closed a safety device prevents the piece from being fired. The normal position of the striker is regulated by the small spring, wherein the cap of the cartridge is protected from accidental blows of the striker. The details of the firing mechanism and the trigger device are shown in figs. 2 and 3.

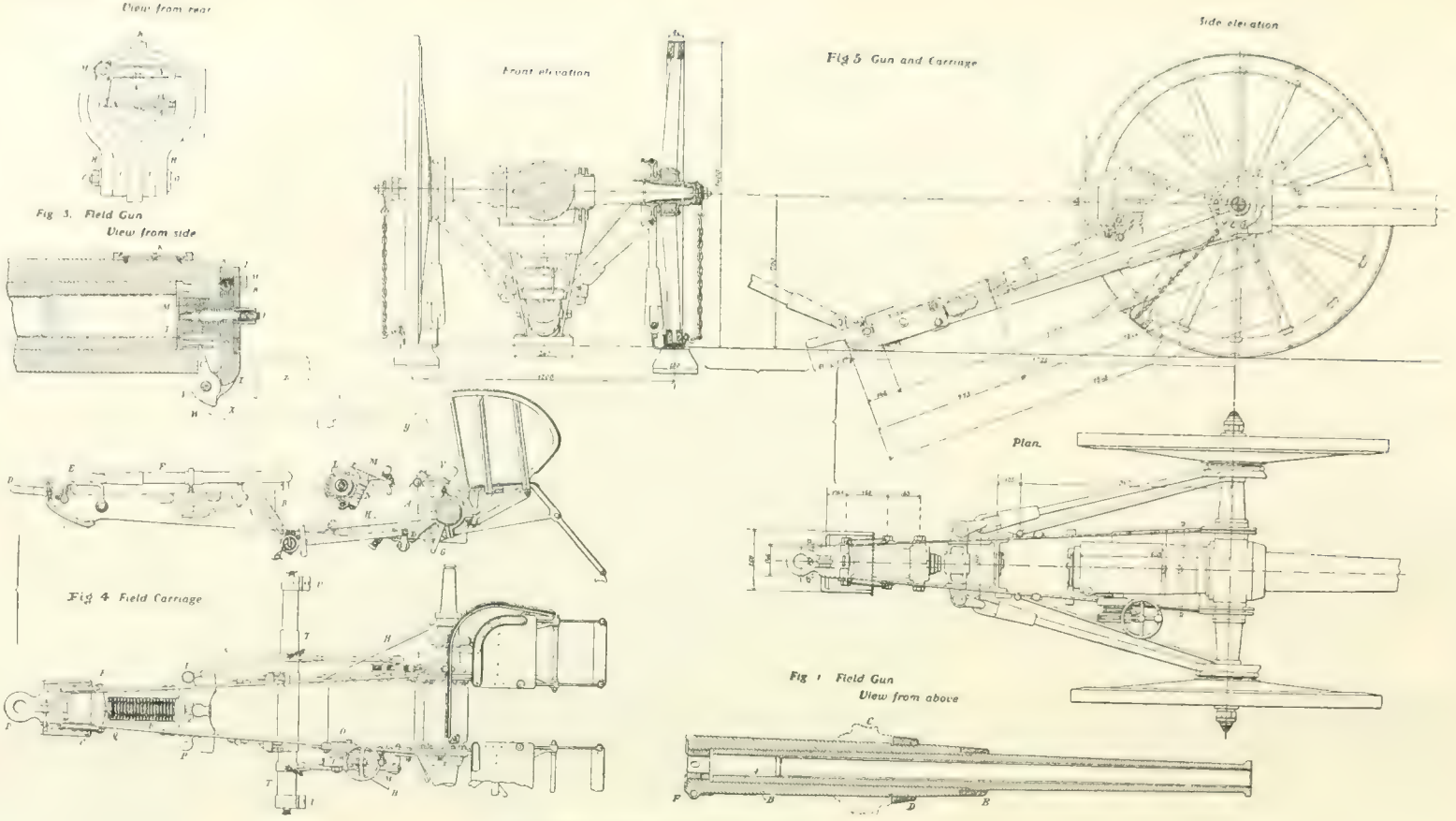
The extractor *T* lies in the lower part of the breech recess and is operated by an arm *U*. This arm is mounted on the same pin *V* that serves as hinge-pin for the carrier, and in its recess has a motion to the front and rear about this axis. On the lower side is a stud *W* against which the carrier strikes when the breech is opened; the arm *U* rotates to the rear actuating the extractor *T*, which ejects the cartridge case.

CARRIAGE.

The trail consists of two pressed steel flasks with curved edges, suitably tied together by transoms. The front end of the trail is reinforced by stiffening plates *A*, bolted on and so constructed as to form the trunnion beds of the gun. The trunnions extend through them and carry the wheels of the carriage at their outer ends. Near the middle of the flasks of the trail the road brakes are hung by the rods *L*. The recoil brake lies at the lower end of the trail between the flasks. At the end of the trail are the trail shoe *C*, the pintle ring *D*, two trail handles *E*, and the folding trail handspike *F*. The carriage also has axle stay rods *H* and two axle seats.

The elevating mechanism is on the right cheek of the trail, and consists of the worm *N*, with hand-wheel *M*, the worm wheel *L*, and the pinion *O*, the teeth of which engage in those of the elevating rack on the gun.

For checking recoil and returning the piece to battery use is made of the recoil brake and wheel-shoes which replace a trail spade. The recoil brake is arranged as follows. On the inner side of the nave of each wheel is a grooved rim in which a traction rope runs (fig. 5). The ends of these ropes are fastened one end to the wheel-shoe and the other to the cross-head *P* (fig. 3) of the piston rod (dotted lines fig. 5, side elevation). In the flasks of the trail there are grooves in which the cross-head slides. When the cross-head is pulled forward by means of the ropes the cup-shaped springs (Belleville) of the brake are compressed. The wheel-shoes are hung from the axle by chains and have spade-like projections on the underside, which sink into the ground when the wheels on recoil force them down. In firing, at the beginning of recoil, the wheels turn and



JAPANESE FIELD AND MOUNTAIN ARTILLERY.

	FIELD GUN	MOUNTAIN GUN
Calibre	75 mm	75 mm
Length of gun	2·2 m	1 m
Length of bore	1·96 m	0·84 m
Number of grooves	28	28
Twist	[illegible]	[illegible]
Depth of groove	[illegible] m	0·5 mm
Diameter of wheels	1·4 m	1·0 m
Height of axle	0·7 m	0·5 m
Height of line of sight	[illegible] cm	70 cm
Length of line of sight	70 cm	40 cm
Value of a deviation on the sight and pointing arc	1/1000 R	1/1000 R
Value of a division on the direction plate	3/1000 R	3/1000 R

	FIELD GUN	MOUNTAIN GUN
Shrapnel weight	[illegible] kg	[illegible]
bursting charge	[illegible] gm	[illegible]
number of bullets	234	[illegible]
weight of a bullet	[illegible] gm	about [illegible]
diameter of a bullet	12·5 mm	about [illegible]
Explosive shell weight	[illegible] kg	about [illegible]
bursting charge	360 gm	[illegible]
Muzzle velocity	1500 f. s.	[illegible] f. s.
Track	1·2 to 1·3 m	7 m
Weight of gun	310 kg	100 kg
of breech block	10 kg	[illegible]
of gun with carriage	840 kg	[illegible] kg
Limits of elevation	11° to + 43°	— [illegible] to + 30°
Weight of powder charge	450 gm	[illegible]

run up on the wheel-shoes, whereby further motion is stopped. At the same time the rear end of the axle-tree draws the rod back to compress the springs and thus checking the recoil. The wheel-shoes are provided in the usual manner to prevent the carriage from moving to the rear. When the gun is on the slope the springs run the wheel-shoes forward, the wheels rolling off the shoes. The axle-tree is thus brought back to its original position; it has to be relaid after each round.

On account of this recoil and the operation of the breech mechanism, which requires two motions in order opening or closing the breech, the Japanese field gun cannot be included in the class of true rapid-fire guns, but only in that of quick-firing guns. As an example the German field gun may be cited.

The hand brake is so arranged that it can be placed lower as is necessary when the gun has to be at great angles of elevation. This brake is operated by the crank handle I on the left side of the carriage. The wheels have sixteen spokes and a metal nave. The mountain gun differs but slightly from the field gun.

Parallel Drive, Lever Release Screwing Machine.

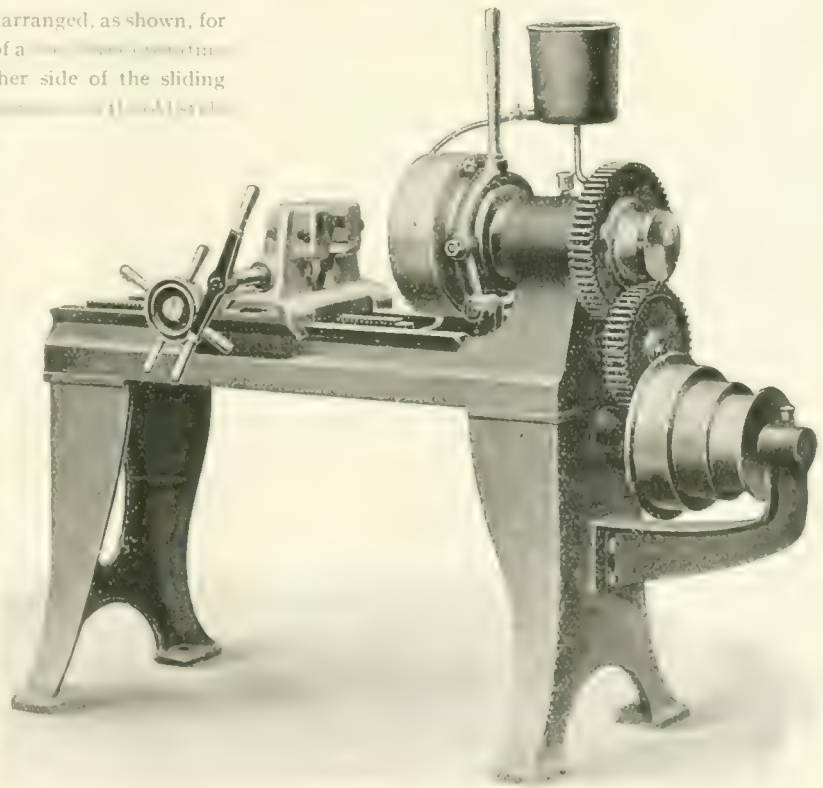
BY MESSRS. CHARLES WINN AND CO., OF BIRMINGHAM.

THE new design of screwing machine illustrated herewith has been designed by Messrs. Charles Winn and Co., of Birmingam, with a view to obtaining a neat and compact parallel drive.

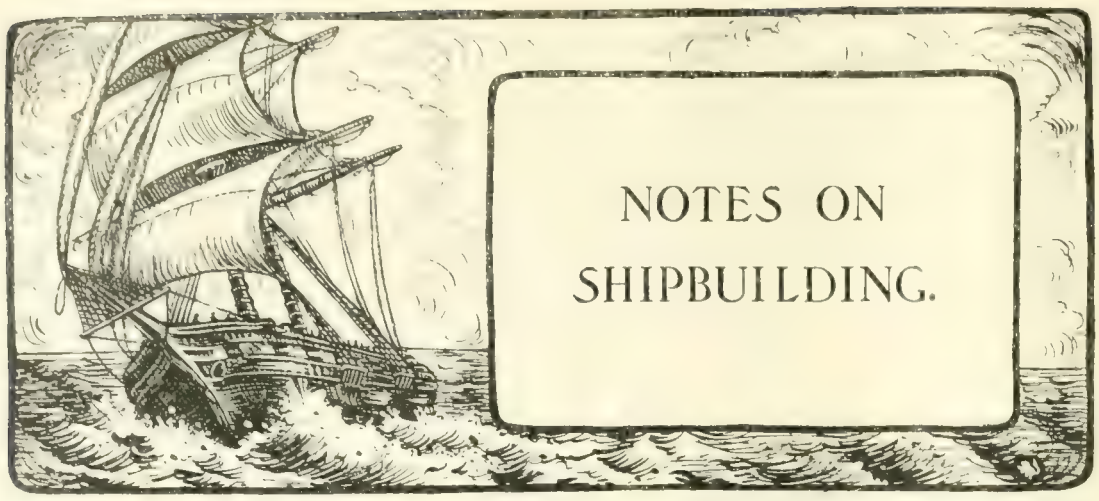
either standard sizes or odd sizes. Each of the dies consists of four chasers, and arranged, as shown, for instantaneous release by means of a gun-metal slippers fitted on either side of the sliding motion, which without stopping the machines; the as before by a and of screwing can be exactly repeated by an

entring pattern; below, but it inside of the spindle.

with an extra long bed providing for 24-in. travel of the work. It is fitted with wheel guards which have been removed for the purpose of illustration.



PARALLEL DRIVE LEVER RELEASE SCREWING MACHINE BY MESSRS. CHARLES WINN AND CO., OF BIRMINGHAM.



NOTES ON SHIPBUILDING.

IN the shipbuilding world the unexpected has happened since the new year, for there has been a quite considerable run of orders in most of the important districts. Many owners who have been holding back, have been placing contracts, and we hear of one firm in the north who have ordered no fewer than ten very large cargo boats, dividing their orders between three builders. Whether the present revival will expire as quickly as did that at the beginning of last year remains to be seen, but whatever shipowners may think of it, the shipbuilding industry is feeling rather better than it did. The new work is, however, very unevenly distributed. Another unexpected thing in the trade is the large output of 1904, which, although below that of the previous year in the whole world, has turned out to be rather better than was anticipated.

The following table condenses the shipbuilding work of 1904 for the whole world. It shows a reduction of 109 vessels of 225,966 tons, and an increase of 15,554 i.h.p. as compared with 1903:—

	1904.			1903.		
	Ves.	Tons.	i.h.p.	Ves.	Tons	i.h.p.
Scotland	300	418,235	462,114	362	484,853	497,300
England	703	849,651	816,482	871	764,105	725,470
Ireland	25	78,124	57,553	25	158,482	128,431
U. K. Totals	1,124	1,370,130	1,335,072	1,258	1,407,441	1,351,317
Colonies	84	25,785	11,710	67	37,225	17,069
Foreign Countries	1,324	1,030,783	1,078,361	1,087	1,233,366	958,852
Grand Totals	2,532	2,426,698	2,425,143	2,412	2,677,965	2,327,238

The reduction in the United States brings that country below the level of the Clyde, which, last year did more than any other shipbuilding district in the world. In 1903 the order of the foremost half-dozen districts was different from 1904. The United States was first and the Clyde second. The Tyne was third, Germany fourth, the Wear fifth, and the Tees and Hartlepool sixth. The following is the order for 1904:—

	Vessels.	Tons.	i.h.p.
The Clyde	326	417,879	432,811
United States	134	324,175	334,005
Germany ...	282	271,043	181,052
The Tyne ...	144	255,229	307,800
The Wear ...	73	228,042	154,185
Tees and Hartlepools	70	214,470	116,720

Among the leading shipbuilders of the year are many changes of position. Messrs. Harland and Wolff, of Belfast, who in 1903 had an output of eight vessels of 110,463 tons, had in 1904 only six vessels of 31,842 tons. The following is the year's order for 1904:—

	Vessels.	Tons.
Russell and Co., Clyde	18	72,850
Swan Hunter, and Wigham Richardson Tyne	22	58,282
Wm. Gray and Co., Hartlepool ...	18	57,857
Wm. Doxford and Sons, Wear	14	55,850
J. L. Thompson and Sons, Wear	13	44,370
Workman, Clark and Co., Belfast	12	44,270

The largest indicated horse-power reported is by Messrs. Schneider and Co., of Crewsot, who engined a very large number of torpedo-boat destroyers. Next is the North-Eastern Marine Company of Wallsend and Sunderland. Messrs. Cramp, of Philadelphia, and the American Shipbuilding Company were third and fourth in 1903 and 1904. Messrs. John Brown and Co., and Messrs. Richardsons, Westgarth and Co. are further down in the list:—

	i.h.p.
Schneider and Co., Crewsot ...	167,200
The North Eastern Marine Company (two shops) ...	162,000
Hawthorn, Leslie and Company, Newcastle	78,800
The United Ironworks, U.S.A.	74,300
The Newport News Company, U.S.A.	70,850
Cammell, Laird and Co., Birkenhead	50,800

The Clyde and Belfast in 1903 launched the largest merchant vessels. Except the *Cedric* there was

having however to compete with Messrs. Inglis and Webb's fast large steamers of 20½ and 21 knots. Great frigates launched in that year by the Lorillard Company of New York. The smallest vessel of the first half-dozen in that year was 15,372 tons and the largest was 22,686 tons. In 1904 there were

Yard	Tons	Engines
Cunard	31,550	John Brown and Co.
Cunard	31,550	John Brown and Co.
Cunard	31,550	John Brown and Co.
Cunard	31,550	John Brown and Co.
Cunard	31,550	John Brown and Co.
Cunard	31,550	John Brown and Co.

The following table summarises the Glasgow district returns of work in the Scottish shipyards during the past year. It shows an increase of 37 vessels, a decrease of 41,616 tons, and a decrease of 10,676 h.p.

	1904			1903		
	No.	Tons.	H.P.	No.	Tons.	H.P.
The Clyde	320	417,870	210,000	283	459,486	220,676
The Forth	47	59,000	30,000	40	52,000	17,000
The Tay	11	7,000	2,000	19	12,000	3,000
The Dee	28	5,110	2,000	27	5,000	2,000
	406	488,980	244,000	369	528,486	242,676

Trade was not good in the shipbuilding yards of the Clyde district in 1904, but it was not so bad as in 1903. The depression of 1903 extended well into 1904. A total of 417,870 tons indicates that in spite of the dull trade which prevailed during the spring and summer a great deal of work was done. Tonnage of a reduction of 59,616 tons from the total of 1903 was a record, and for figures as low we have to go back to 1897, when the total was 391,815 tons. The reduction on the year would have been much greater had it not been for the launching of an unusually large number of small vessels, steamers, lighters, etc. Altogether, Clyde builders turned out 320 vessels of 417,870 tons as compared with 283 vessels of 459,486 tons in 1903. In 1903 the average size was 1,623 tons in 1904 the average is only 1,305 tons. This does not indicate that there were not many large vessels floated, but only that there was also a large number of small vessels. Only one the Cunard steamer *Caronia* was over 20,000 tons; two the cruiser *Natal* and the Allan turbine liner *Virginian* were between 12,000 and 13,000 tons. One the Allan liner *Calgarian* was between 10,000 and 11,000 tons, and one the *Duke of Argyll* was between 9,000 and 9,000. Of intermediate sizes the majority were between 4,000 and 5,000 tons, a number of which vessels were launched mostly cargo steamers. It is when we come down below 3,000 tons that the ships which run up the numbers of launches and increase the average size are found. Between 1,000 and 2,000 tons 40 were floated; between 500 and 1,000 there were 90; while under 100 tons there were 30.

The honour of launching the largest vessel in the world belongs to the Clyde. Messrs. Russell and Co. launched with 17,000 tons. Until that vessel is on the Clyde is only equal to the fact that Messrs. John Brown and Co., Clydebank, had launched vessels of that but a few months to that they produced the largest tonnage for half a dozen consecutive years. In 1904 Messrs. John Brown launched only 31,550 tons. Messrs. Russell launched a large tonnage followed by that of Messrs. Charles Connell and Co. Clyde who had four vessels and Messrs. Barclay, Curle and Co. Partick who had seven. With the exception of Messrs. Russell and Co.'s figures there is no very outstanding total on the year, but all the leading firms had respectable tonnages, while several had large increases. The largest increase after Messrs. Russell and Co.'s are those of Messrs. Charles Connell and Co. from 18,000 tons to 31,550; Messrs. Barclay, Curle and Co. from 12,000 tons to 31,550; and Messrs. A. McMillan and Son from 4,855 to 15,000.

The distinctive vessels of the year were undoubtedly the Allan turbine liners four of which the *Virginian* was launched by Messrs. Alexander Stephen and Sons, Glasgow), and the Cunard liner *Caronia*, launched at Clydebank. The *Virginian* will be notable as one of the first pair of turbine steamers in the Atlantic trade. The *Caronia* is one of the largest vessels ever built in the world and is one of the most notable Cunard fleet in the way of internal fittings and arrangements. One most interesting feature of the year's work is that of Messrs. William Denny and Brothers, Dumbarton. This firm launched no fewer than seven turbine steamers, a record which even they are not likely to surpass until the turbine becomes practically the universal form of marine engine. Other turbine vessels launched on the river were the four mentioned already mentioned and the yacht *Narcissus* from the yard of the Fairfield Company. The *Narcissus* is a departure from the hitherto accepted plan of having triple shafts and screws in turbine propelling vessels. She has ordinary twin-screws.

Of the old-time sailing ship, only sixteen may be found in the list. Messrs. A. McMillan and Son, Dumbarton, launched a barque of 1,800 tons for Aberdeen. Messrs. William Hamilton and Co., Port Glasgow, two barques each of 1,000 tons for Hamburg; the Grangemouth and Greenock Company, a barquentine of 1,000 tons for Hamburg and a steamship of 2,000 tons for Antwerp; and Messrs. A. Rodger and Co., Port Glasgow, a sailing ship of 1,000 tons for Hamburg. Apart from these the sailing ship of foreign exhibits and traffic.

MACHINERY FOR TEA ESTATES.

It was inevitable that with the march of time imperfect and primitive methods of tea manufacture, dependent for the most part, upon coolie labour, should give way to machinery from the western world. That the hand and foot of the coolie actually employed in the various stages of the manufacture have happily been eliminated is certainly calculated to enhance the æsthetic joys of the tea drinker. Machinery, moreover, performs the many little duties incidental to the manufacture with scientific accuracy. A poineer in this field is Mr. S. C. Davidson, M.I.M.E., of the Sirocco Engineering Works, Belfast, and to Messrs. Davidson and Co. Ltd. we are indebted for the following details of modern tea machinery.

LEAF WITHERING.

The freshly-picked leaves of the tea plant, brought in baskets to the factory in a crisp and brittle condition, are first carefully weighed, and then spread out on shelves or racks in the withering lofts, in order to produce the soft limp state which is necessary for subsequent manufacture, and it is here that Messrs. Davidson's Sirocco system of tea leaf withering is able to secure the desired results independently of climatic conditions. The system involves the mechanical movement and control of the entire volume of air in the withering loft by use of "Sirocco" fans, and special means are taken for directing the flow or air current over the leaf spread on the racks. Messrs. Davidson's system enables the process to be carried out in from 12 to 16 hours, even under the most unfavourable climatic conditions, whereas, ordinarily, 24 to 36 hours would be necessary, or even longer in very moist weather. The spreading surface for withering can be reduced as the withering of each day's leaf is ensured. The "Sirocco" system is arranged strictly in accordance with the particular needs of each factory.

ROLLING MACHINERY.

When withered, as the tea is sufficiently limp to admit of twist without breaking it is put into the rolling machine, an example of which is shown in fig. 1, the object of this process being to break up the cells of the leaf prior to fermentation. This machine takes a charge of about 200 lb. of withered leaf which represents the effective work of about 100 coolies. When in the rolling machine the leaf is subjected to a strong lateral pressure by the movement of the table under the hopper, in which what are termed "ploughs" are fitted. This movement causes, as it were, a boiling up motion in the centre of the mass of leaf, whereby the leaf receives a remarkably equal and well twisted rolling, and at the same time is kept cool throughout its entire mass.

ROTARY SIEVE.

The leaf, or wet roll, as it is then called, is next passed through a rotary sieve, which serves to break up any unsuitable aggregations of leaf, and separates the finer tea from the coarse, so that in the subsequent fermenting process the different classes of leaf can be fermented separately and best results obtained, as the finest qualities, which ferment fastest can be dried off as soon as they have obtained a sufficient degree of fermentation.

DRYING THE LEAF.

The drying of the leaf after fermentation is one of the most important features of the tea manufacture and considerable ingenuity has been shown by Messrs Davidson and Co., Ltd., in producing various types of drying machines to suit all requirements, and in sizes to deal with from 40 lb. to 350 lb. of fully dried tea per hour. These drying machines are made in two distinctive types, viz: "Downdraft" and "Updraft" In the former (an example of which is shown

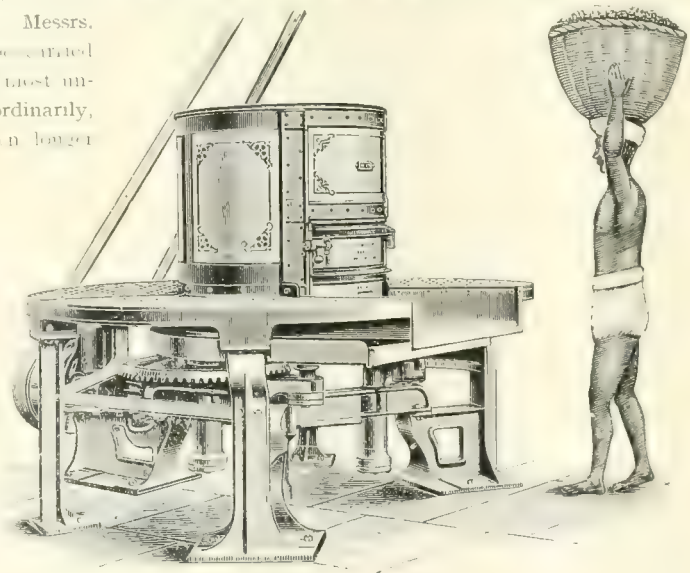
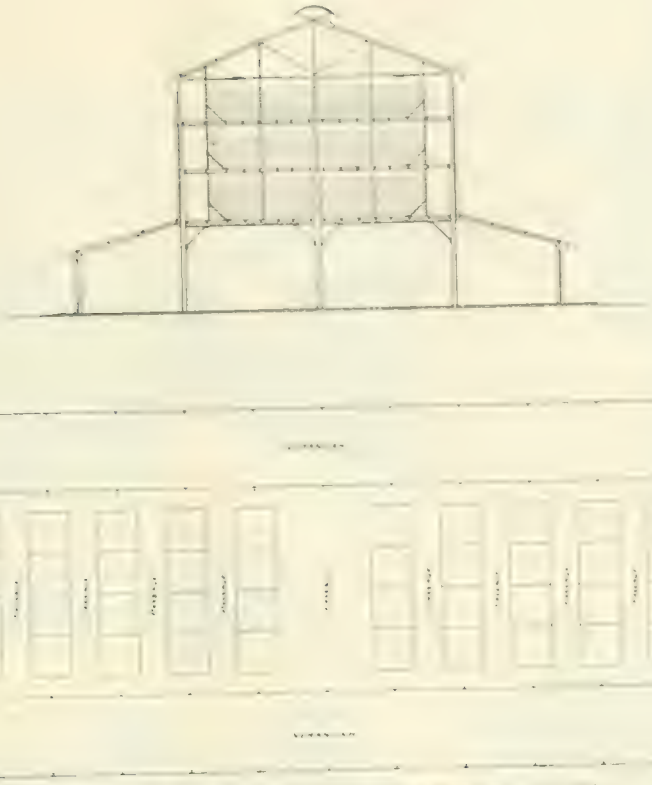


FIG. I. ROLLING MACHINE.



PLAN AND ELEVATION OF AN IMPROVED TEA-HOUSE,

Illustrating the latest improvements in the design of Tea Factories as carried out by Messrs. Brownlie and Murray, Ltd., of Glasgow. The standards of the withering racks are carried up to the roof principal and the withering trays are placed across the building, thus giving effective drying accommodation.

A TYPICAL LEAF-HOUSE,

Erected by Messrs. Brownlie and Murray, Ltd., on the Kelly-den Tea Estate, India. The building has open sides, is 175 ft. long by 34 ft. wide, and has eight withering lofts. The floors are of timber.

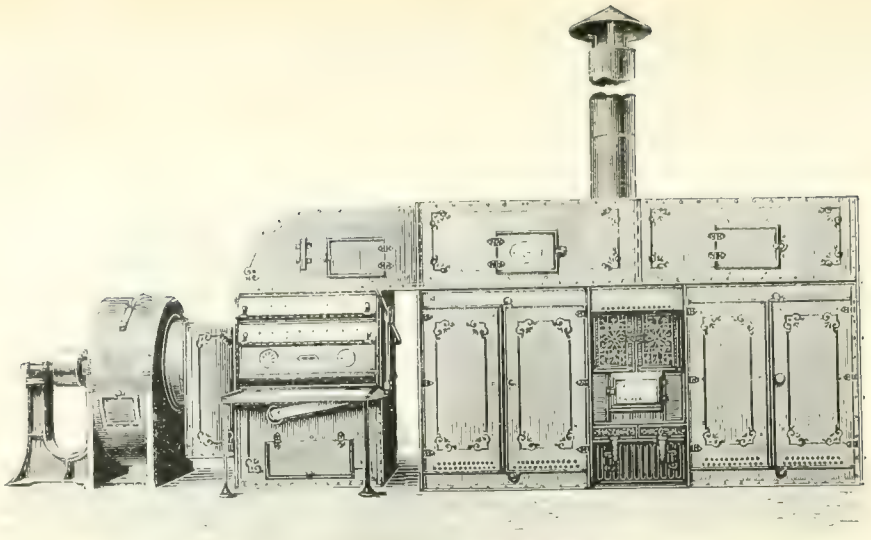


FIG. 2. DOWNDRAFT DRYING MACHINE.

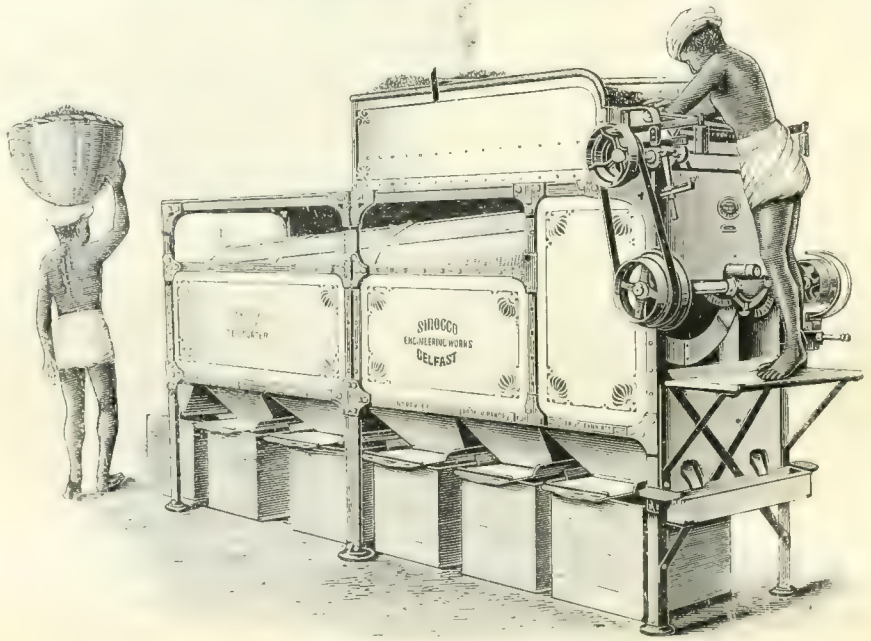


FIG. 4. TEA SORTING MACHINE.

FIG. 5. TEA PACKER.

...ng at the rear or ...ward ... the stove is drawn down through the trays on ... and ... by means of a ... centrifugal fan. The trays in the drying chamber when ... opened by a ... are inserted through the bottom, ... and gradually raised by ... until they come opposite the top door, when they ... withdrawn for loading from the front.

The Updraft Suction Drying Machine (fig. 3) ... the same leading ... with a ... current of heated air, and does not require any mechanical power. As will be clear from the accompanying illustration, the chamber containing the trays is above the stove, so that the upward current of heated air passes through the leaf spread on the trays. Afterwards it passes either into the factory, or up the chimney, as desired. These machines are made in two types, in one of which the trays are inserted at one end of the machine, and in the other at the side of the machine.

We are informed by Messrs. Davidson and Co., Ltd., that they have just shipped to India the first of a new and improved form of drying machine of the automatic type, designed to deal with 350 lb. of tea per hour. Only one attendant will be necessary to feed the leaf into this machine, and it will be entirely ... when the drying process is completed. The power required for driving the ... has been reduced to a minimum, and special attention has been given to strength, simplicity of construction, efficiency, and economy in working.

Any class of fuel may be used in the stoves with these driers, and a special attachment has recently been patented for the application of oil fuel, which will be of special interest to planters in districts where wood is becoming scarce.

SORTING AND GRADING.

Mechanical appliances are also provided for the sorting or grading of the tea (fig. 4) when dried, into various parcels, and also a machine for packing it into chests. We understand that the latter operation, until a recent period was effected by coolies tramping the tea into chests with their bare feet, and though we have not seen this operation performed, we should distinctly prefer Messrs. Davidson's Mechanical Packer. The machine has a vibrating table on which the chests are clamped, and to which is imparted about ... vibrations per minute. This vibrating motion causes all the particles of tea to settle down closely in the chest, which is thus filled compactly and uniformly, 110 lb. chest of tea taking about two minutes to pack. Fig. 5 is an illustration of this interesting machine.

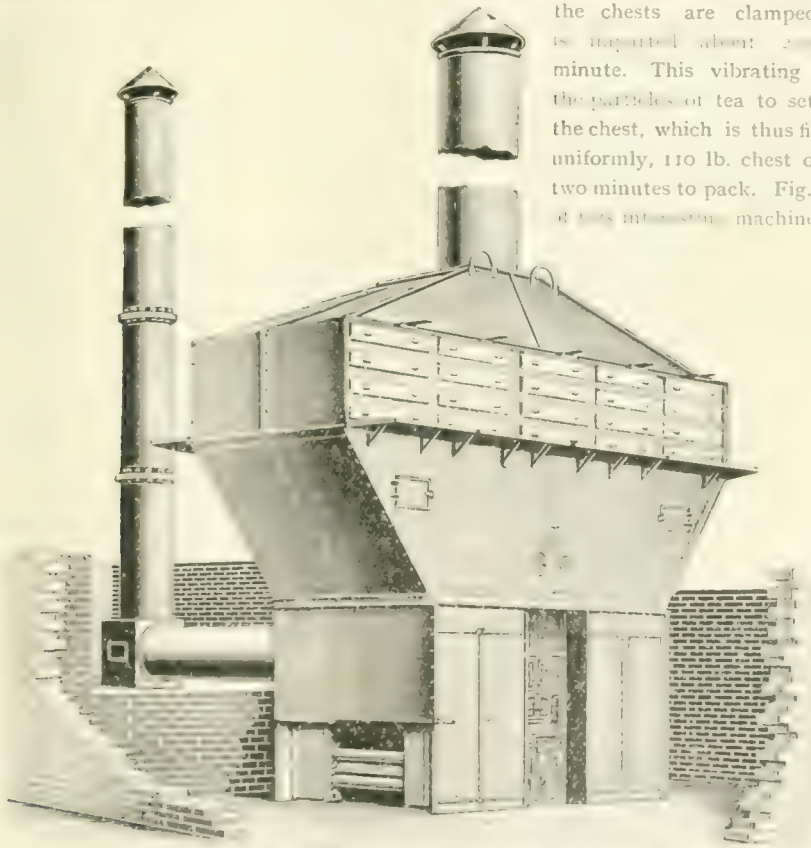


FIG. 3. UPDRAFT DRYING MACHINE.

IRON AND STEEL NOTES.

(*Continued from page* 103.)

I NOW conclude the extracts from the useful paper which Mr. Jos. H. Harrison read before the Cleveland Institution of Engineers. With regard to blowing engines, Mr. Harrison thinks Cleveland can claim to be a pioneer in this country, both in gas-blowing engines and turbo-blowing engines but we follow painfully slowly. Both these are successful. The former, including its auxiliaries, takes more looking after than the usual steam reciprocating engine, but it uses only about one-third the gas. The turbo blower requires no less steam, but takes much less attention and oil, and gives no pulsations of blast. Both these innovations are distinctly improvements, and will be rapidly taken advantage of. Pyrometers are now becoming very common about blast furnaces, but there are still many who do not see the value of them. A furnace run without a pyrometer is very much like a ship sailing without a compass.

———

Leaving the blast furnaces, to go to the steel works, continues Mr. Harrison, we pass the metal mixer on the way, or if we don't we ought to do. The mixer is the great buffer between the blast furnaceman and the steel maker. It enables the former to get a good lot of iron through into steel, which would have otherwise gone to rust in stock, owing to its quality, and it enables the latter to know pretty nearly what sort of iron the next ladle will bring. Both these reduce cost, and increase output.

On reaching the steel works, possibly the first thing that strikes one is that the mill is not rolling at that moment—this may be due to fifty different causes, but it is most likely to be due to one of two—either the steel is not ready for it, or the finished product has not been got out of the way. The author thinks there is not a single steel works mill in this country where an average of from one to two hours is not lost on every shift, from one or other of these two causes. He considers this is one of the most telling factors in looking for the cause of falling behind our competitors in steel production. He thinks that those who have just returned from America will back him up by saying they saw no time lost on mills over there. The mill is the hub, around which everything must turn, and it is our failure to appreciate this that allows things to go on as they do. You may have half a dozen melting furnaces, with all necessary heating, and cogging appliances to prepare the raw material, but you have only one mill. That mill measures the work done, and it must be kept going all the time at full speed, if the plant as a whole is to make profits. Every single operation, both before and after it, must not only be able to keep step with it, but must have a bit up its sleeve, to meet an extra spurt of the mill when it has an easy order on. If the furnaces cannot make steel enough for the mill, and you are quite sure nothing is holding them back, put down more furnaces. Far better spend money this way and get a return, than to have men and machinery eating their heads off. Every one of them has got to earn a profit, and if you don't give them enough employment, how can they?

———

As a rule, the ingots here are not given time enough in the furnace. This is due largely to a deficiency of furnaces, and it results in very excessive rejections of finished products. Quick-acting cranes, or machines, to charge and draw the ingots, with rapid means for lifting doors, and men trained to keep the cogging mill supplied with steel just as fast as it can be finished and taken by the finishing mill, are points to be carefully noted, and seen to. Then, looking at the other frequent cause of stopping the mill—the finished material not out of the way. If a mill can roll so many tons per shift, whether plates, rails, or anything else, it requires no great thought to see that you must not only provide sufficient machines to finish that quantity per shift, but also room for it to cool, and yet this is the point where the delay mostly occurs.

It is quite common knowledge that our competitors have a much better plan, and yet we make no effort to follow it. By putting a sufficient length of light, slow-moving roller gear from the mill roller gear to the shears, and letting the plates simply crawl along this, the air can get all round them, and they will be cooled by the time they get to the shears, and be far less buckled than at present, besides costing nothing for labour. If sufficient ground length is not available on the straight it is quite easy to arrange roller gear side by side, and skid the plates from one to the other at the ends, so that they travel up and down and finally arrive at the shears. The plates can be inspected and marked as they crawl along. They are kept orderly and travel with regularity out of the way of the mill which is thus enabled to increase its output by 50 per cent. The plates are thus kept well above the ground level, where they get plenty of fresh air, and there is a

chance keeping the roller gear under supervision. There is also no uncoupled cooling to cause excessive buckling.

Going further into the buckling question, Mr Harrison asks why the buckles are not taken out before the plates leave the works? When a buyer orders plates he expects to get flat ones but he never does in this country. Wherever one goes into a bridge, boiler or other shop where plates are being used, we find men laboriously flattening those delivered either by hammers or flat blocks or by passing them through a series of rollers. It is not only the platemaker's business to flatten his plates and trim the job, but he can do it far more easily and cheaply than anyone else by passing them through a series of rollers before they are cold as they are crawling down from the mill to the shears. Our American friends do it regularly and why should not we? One machine would do the work of ten in the buyers shops and would do less harm to the plate.

If the product is rails or other sections greater hot bank room is required than is found at most mills, so that the bars can lie to cool without touching each other having an all round them with a view to reducing the straightening to a minimum. This straightening is a very serious business indeed with us. There is far too much of it at many works. It is not only expensive, but it checks the output of the mill. Provided the ingot or the bloom is properly heated and the rolls are right, there should be very little straightening required if care is taken in cooling the bar. A rail is symmetrical in section and a little judgment in cambering it should produce a fairly straight bar. At any rate there is no excuse for some of the snakes one sees waiting to be straightened and some interference should be used to stop it.

Open hearth furnaces have made rapid strides in recent years both in capacity of furnace and output. Mechanical charging machines are not yet generally used. They not only save heat as cold air does not enter the furnace doors but charge the material in a fraction of the time so that the doors are not letting cold air in to cool things like the same extent. The machine can do the work at a fraction of the cost so that wages can be saved and the machine takes no note of hot days.

The tilting form of furnace is an expensive one but it does away with all tapping hole troubles, and for the Talbot process it is ideal. This process is satisfactory at Frodingham and a second furnace is being erected there, so that there is no further reason to hesitate in adopting it here. Here too three of these furnaces are now being erected at one works but these firms do not follow practice. The old fashioned system of casting ingots from the open hearth furnace in a pit still exists even though the ladle is handled by an overhead crane. When the time has got to cast the metal does it is quite a close matter to lift it high enough to clear the moulds set on boxes running on a railway on ground level. This saves all the mess in the pit and lets the steel go straight to the stripper crane and the ingots are in the heating furnace with far less trouble, expense and loss of time.

The clearing and drawing of the ingots and slabs should be no longer a job for half a dozen men. With the machines now well known it is only a one man job with a boy to lift the doors and he is far more reliable than the half dozen to keep step with the mill's requirements. He has no one to blame for any delay, and he puts the piece in the right place every time. With regard to the speed of rolling rails and bars, the pieces don't follow up quickly enough. There is no need for the roughers to be simply spectators of the finishing process. They should have a piece in all the time, both roughing and finishing. It is a fact that in America they have to hold back seven or eight rails and they are cool enough for the finishing pass. There is no such trouble here. Probably some of this excess of heat is due to better heating, but the quicker following up has much to do with it. In cropping the ends of blooms and slabs, it is a crude method to lift each crop end with dogs and a crane. Why not run a bogie under and shoot the crop ends down into it? If a railway can't be got in shoot them down into a box and let one lift do for a hundred.

It has been truly said it is waste of time and money to simply copy literally American plant and methods because their conditions and ours are widely different. But there is very little difficulty in selecting from their stock of these articles such as are suitable for our conditions and adopting others to work therewith.

The American aim is to secure large outputs and consequently good dividends. With us the first aim is to get dividends and no credit is given for record output if the dividend is reduced. This makes a world of difference. Mr Harrison is of opinion that Americans are ever ready to the mark to their eagerness for "record outputs." He opines that there is a gulf to be crossed between their practice and ours, which if properly bridged will give "record profits."

BRITISH COAL.

POSSIBLE ECONOMIES IN PRODUCTION AND USE

IN our last issue we called attention to the estimated amount of coal in the British Isles and some other salient features of the valuable and suggestive report of the Royal Commission on Coal Supply. As regards the available coal the report is a distinctly cheerful document. We have often been assured that the use of coal will become obsolete within a measurable distance of time, and this has been put forward as an answer to those who view with alarm our exports of steam coal. In any event it appears that there is a very wide margin available, for we have enough coal to last from 400 to 600 years. The most suggestive and valuable part of the report is that which deals with possible economies; (1) underground, (2) in the preparation of coal for the market, (3) in transport from the collieries, and (4) in use.

THE TENTATIVE NATURE OF COAL STATISTICS.

As regards the total estimate of available coal we welcome the figures given for their magnitude, but how tentative such compilations are, is illustrated by the fact that although between January 1st, 1870, and December 31st, 1903, 5,694,928,507 tons of coal have been raised, the present estimates of available coal are nevertheless 10,707,382,769 tons in excess of those of the previous Commission. This excess is accounted for, partly by the difference in the areas regarded as productive by the two Commissions, and partly by discoveries due to recent borings, sinkings, and workings, and more accurate knowledge of the coal seams.

The calculations of the Commission as to the available resources are based for the most part upon the assumption that present conditions will continue, but they are fully alive to the possibility that improved methods and appliances will result in the getting of a greater percentage of coal than that which they have estimated to be available.

As already explained the Commission regard 4,000 ft. as the limit of practical working. At the same time they point out that it is difficult to determine the maximum temperature which is consistent with the healthful exercise of human labour. There seems, however, to be no difficulty in working at upwards of ninety degrees provided the ventilation is brisk and the air dry. Experts on the Continent, notably Professor Stassart and Herr Schultz-Briesen, consider 1,500 metres, or say 4,900 ft., about the limit of working.

PROBABLE DURATION OF OUR COAL RESOURCES.

This question, the Commissioners point out, turns chiefly upon the maintenance or the variation of the annual output. The calculations of the last Coal Commission as to the future exports and of Mr. Jevons as to the future annual consumption make them hesitate to prophesy how long our coal resources are likely to last. The present annual output is in round numbers 230 million tons, and the calculated available resources in the proved coalfields are in round numbers 100,000 million tons, exclusive of the 40,000 million tons in the unproved coalfields, which they have thought best to regard only as probable or speculative. For the last 30 years the average increase in the output has been 2½ per cent. per annum—and that of the exports (including bunkers) 4½ per cent. per annum. It is the general opinion of the District Commissioners that, owing to physical considerations, it is highly improbable that the present rate of increase of the output of coal can long continue—indeed, they think that some districts have already attained their maximum output; but that on the other hand the developments in the newer coalfields will probably increase the total output for some years. In view of this opinion and of the exhaustion of the shallower collieries they look forward to a time, not far distant, when the rate of increase of output will be slower, to be followed by a period of stationary output, and then a gradual decline.

COAL-CUTTING MACHINES.

Coming to underground economies, almost all the opinions given on the general question of coal-cutting machines compared with hand labour were, as already noted, in favour of the former, but these opinions were accompanied by many qualifications and exceptions, and it is apparent to the Commissioners that the balance of advantage and disadvantage depends to a large extent upon the circumstances of each pit, and sometimes of the different districts in the same pit. The choice of machine also depends on many circumstances. There seems to be no doubt that coal-cutting machines are now firmly established.

The chief advantages of coal-cutting machines, according to the evidence, are set forth as follows:—(1) That an increased percentage of large coal is obtained, and the coal got is in a better and better condition. (2) A more regular line of face is obtained, which facilitates ventilation and leads to more regular and systematic timbering and the weight being more regular and uniform the roof can be more easily kept up. The greater rapidity of working also tends to keep down the cost of repairs, and causes less damage to overlying seams and the surface, the subsidence being more even. (3) The regular and systematic working tends to increase the safety of the workmen. (4) Seams, which either because of their thinness or hardness, or both, could not be worked at all, or could only be worked at a profit in small areas, can be worked profitably by machines. (5) Holing is less frequently done in the coal and when it is there is much less "stuff" made than in the case of holing by hand. (6) The output is increased and is more regular, and the work is more easily superintended. Fewer explosives are used for getting down the coal; in some cases none. Generally, machine work is less costly than hand work, especially in thin seams. According to one witness the saving is much greater in the narrow work of roadways than in the longwall faces. From the point of view of the men the work is safer and easier, and the wages are better. The importance of lightening the labour of the men will probably be more appreciated as the working places become fewer and the temperature thereof higher.

There are however certain conditions under which coal-cutting machines at present do not work to advantage, viz., where the cost of dealing with falls or other troubles or delays is excessive, or where the coal is hard to undercut, as may be the case in parts of very soft coal that is full of bands, or in the hardest of hard coals, or where there is much damage to the machines.

EXPLOSIVES AND SUBSTITUTES.

Although the general use of the extended use of coal-cutting machines has apparently been to reduce the use of explosives, it appears that in some cases shot firing has increased, because of the larger blocks brought down. For many years attempts have been made to devise some sort of appliance which would exert the necessary force. Hydraulic cartridges, steam wedges have been tried, but hitherto without much success. It is claimed that the hydraulic cartridge or wedge which is now used in at least one colliery in Lancashire, has enabled shot firing to be dispensed with altogether, and has at the same time given a greater percentage of large coal.

ELECTRICITY AND COMPRESSED AIR.

At a modern colliery, and especially since the introduction of coal-cutting machines on a large scale, the use of electricity for the transmission of power is according to the evidence invaluable both from the point of view of economy and efficiency. It is said to be well adapted for every requirement of mining and for all the general purposes of a colliery, with the possible exception of the winding engines, the opinion in this country being at present against using electrical winding engines, although some are being used on the Continent.

In connection with the preparation of coal for the market the Commission strongly emphasise the great advantages obtainable from improved machinery for the better handling, the avoidance of breakage, &c. Not only is the value of the product thereby greatly enhanced, but much small coal formerly unsaleable at a profit and, therefore, not worth bringing to the surface is now brought out and sold to advantage after washing. Such careful preparation of the output has not however found universal application in this country. It is said that we do not lay ourselves out to suit the requirements of our customers either at home or abroad, and that as regards foreign markets the methods of our Continental competitors, especially Germany, are more scientific and more satisfactory. They strongly urge the importance of cleaning, sizing, and sorting coal for the market. The more the coal-owner knows the circumstances that govern the use of coal, and succeeds in supplying those special requirements, and explains the best coal they expect and the usual methods of riddling and sizing. Customary competition, a guaranteed analysis gives users a right to rely upon always getting what his experience has proved to be most suited for his purposes.

(To be continued.)

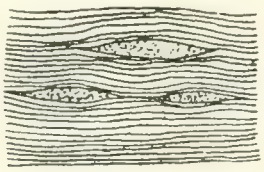
MICA MINING IN SOUTHERN INDIA.

A paper on this subject was read before the last meeting of the Institution of Mining and Metallurgy by Mr. George A. Stonier, of which the following is an abstract:—

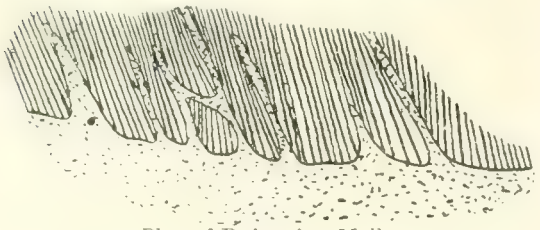
Mica mining in India is of importance in only two areas, Kodarma and Nellore. This paper deals with the latter district. The area over which payable mica has been found in Nellore measures 114 miles by 48. It consists of a series of well-foliated garnetiferous, talcose, chlorite, biotite, hornblende, kyanite, and staurolite schists, quartzites and gneisses of older palæozoic age, and is penetrated by a number of sheets, dykes, and small bosses of pegmatite.

The payable "books" of muscovite are at, or close to, the junction of the pegmatites with the biotite and hornblende schists, but are never found in the latter.

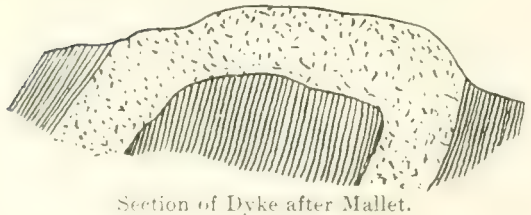
The plan of working is to quarry at the junction of the pegmatite and schist and as the dip of the junction is high quarrying can be continued to a great depth. Very little underground mining has been attempted. Kodalis are used to excavate the soft earth, but to quarry to pegmatite men work in pairs, and use 10-lb. hammers with 15-inch handles and small wedges.



Lenticular Pockets of Pegmatite after Mallet.



Plan of Dyke after Mallet.



Section of Dyke after Mallet.

Boring holes for blasting is done with hand driven 1 in. octagonal drills, 18 in. to 4 ft. in length. Eight feet of drilling per day in quartz and 12 to 14 ft. in felspar, is considered a day's task; the deepest hole is 4 ft. The mica is prepared for market by splitting up into flat pieces not more than ⅛ in. in thickness, free from flaws, and cracks, and without cross graining. They are finally cut into rectangles, tied into bundles, and packed in mango wood boxes. Only 10 to 15 per cent of the mica mined reaches the market.

MULTIPLE EFFECT EVAPORATION.

A paper under this title was read before the Manchester Association of Engineers on Saturday last by Mr. Charles Day. The following is an abstract:—

In dealing with the concentration of certain liquors, it is desirable that the highest density should be accompanied by the highest temperature, as owing to the increased fluidity at higher temperatures the concentration can then sometimes be carried to a greater degree. Under such circumstances the liquor instead of entering the first vessel and finishing at the third in the usual way, may have its passage through the machine reversed; this, however, necessitates pumps to convey it from vessel to vessel owing to the pressure rising in the direction of the flow instead of falling.

AN IMPORTANT FEATURE IN DESIGN.

In the design of evaporaters of the type under consideration, one important point is the rate of heat transmission through metallic surfaces. This is a subject which, though much experimented upon, is still very vague, and is one worthy of further investigation. The experiments which have been made with surface condensers and with evaporator tubes of various diameters have given very contradictory results. Newton's law that the transmission of heat is directly proportional to the difference of temperature in no longer accepted as true. The most complete series of experiments of which the writer has information are those of Mr. G. A. Hagemann, of Copenhagen. An extract of these can be found in the "Proceedings of the Institution of Civil Engineers," Vol. 77. These experiments included determinations of the rate of heat transmission through brass tubes for different ranges of temperature and for different rates of flow of liquor through the tubes, steam being on the outside of the tubes. The experiments were made with vertical tubes and may not apply equally to horizontal ones.

THE EFFECT OF TEMPERATURE.

Experiments show that there is an increase in the rate of evaporation per square foot by rapid circulation of the liquid in the tube, and doubtless this applies not only to evaporators and condensers but also to boilers.

Figs. 1 and 2 show that the rate of transmission per degree of temperature difference is greatest when the temperature difference range from 5 deg. F. with a low speed of flow to 30 deg. when the speed of flow is 8 ft. per second. The curve F shows the results obtained when the water in the tube was cooling, the rate of flow being only that arising from the disturbance due to ebullition. When compared with the results obtained at low rates of flow (see curve B) it will be seen that the rate of transmission is much higher when heat is transmitted to a boiling liquid than to one not boiling. Other experimenters

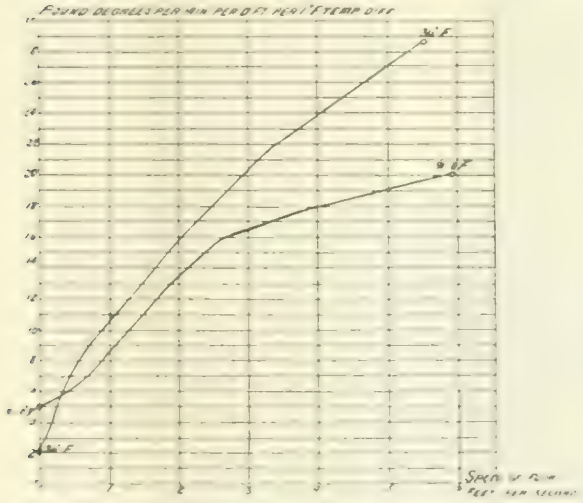


FIG. 1. DIAGRAM SHOWING TRANSMISSION OF HEAT WITH A CONSTANT "TEMPERATURE DIFFERENCE" AND A VARYING SPEED OF FLOW.

have found that the heat transmitted per square foot is three to four times as rapid when the liquid is boiling than when otherwise, which fact may explain the greatly improved output from boilers when very hot feed-water is supplied to them. Possibly the advantage of live steam feed-heaters on board ship may be largely due to this cause.

SIX-EFFECT YARYAN EVAPORATOR.

Fig. 3 is a diagrammatic drawing of a six-effect Yaryan evaporator, and from it the course of the liquor to be evaporated, and of the steam causing the evaporation can readily be traced. When used for the distillation of water the impure water is drawn from the circulating water which has passed through the condenser and which has thus been somewhat heated. It is then pumped through the first heater, then forward through the second heater, thence passes through heating tubes, shown dotted on diagram

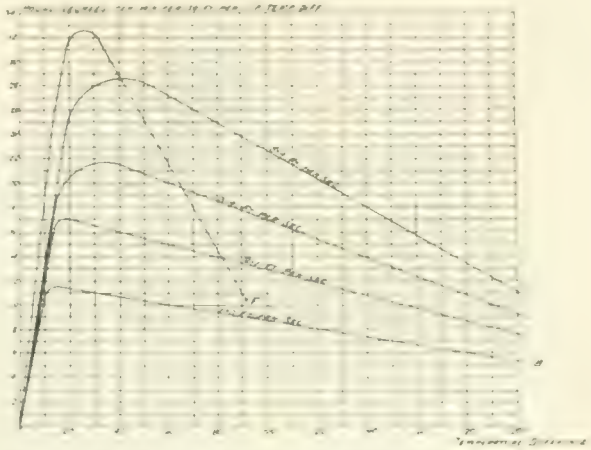


FIG. 2. DIAGRAM SHOWING TRANSMISSION OF HEAT WITH A VARYING "TEMPERATURE DIFFERENCE" AND A CONSTANT SPEED OF FLOW.

By the time it has passed through the last set of heating tubes which is contained in the first or high temperature effect or vessel, its temperature will not be much below the temperature of the steam supplied to that effect. At this point, or if preferred at any earlier point, it may be taken to a specially constructed lime catcher, shown on top of separator column, containing a steam coil which brings the water to that temperature at which most of the lime and similar salts are readily precipitated. Suitable reagents may be added to assist precipitation. Before leaving this lime catcher the water is filtered; it then passes to the evaporating tubes of the first effect. The shell of this vessel or effect receives steam from the boiler at a pressure of about 40 lbs. per square inch. In many cases a higher pressure and a greater number of effects may be adopted, when the liquor is such that treatment at a high temperature is not likely to be injurious, but machines are seldom made with more than six effects.

SIX-EFFECT EVAPORATOR.

The water obtained by the condensation of steam supplied to the first effect is usually returned direct to the boiler, thus the boiler is fed with pure distilled

water at a high temperature, consequently a high evaporation per pound of coal should result and be well maintained. The steam formed in the tubes of the first effect, together with the water, pass to the separator S1, where the steam separates from the water and is led to the shell of the second effect, whilst the water passes into the tubes of this effect. The pressure in the shell of this effect practically corresponds with the pressure in the tubes of the first effect, but the pressure in the tubes of the second effect is several pounds lower, hence as the water entering the tubes is at the higher temperature of the previous effect there is immediate and spontaneous evaporation of some of the water, and this causes a lowering of the temperature of the remainder, which reduction of temperature permits of heat being transmitted through the tubes from the steam on the other side, causing evaporation of a further quantity of water and the condensation of the steam outside of the tubes.

Again the mixed water and steam pass to the separator S2, and the separated steam is then led to the shell of the next effect, and the water to its tubes, but as the water produced by the condensation of the steam supplied to the shell of the second effect is not wanted for boiler feeding, it is drained into the shell of the third effect as shown, and there imparts some of its heat to the water in the tubes. Spontaneous evaporation also takes place here, owing to the water entering a vessel in which the boiling temperature of water is lower than the temperature of the incoming water.

This cycle of operations is repeated in succeeding effects until the last one is reached, which, in the example chosen, is the sixth effect. From here the water drained from the second, third, fourth, and fifth effects, together with the water of condensation formed on its own tubes, is drained to the second heater, whence it passes to the condenser. The steam from the last separator, S6, passes at this stage to the first heater where some of it is condensed, the final condensation taking place in the surface condenser shown, where not only does this condensation take place, but the water so formed is, along with the water drawn from the previous shells, finally cooled by the circulating water in condenser.

A VITALLY IMPORTANT POINT.

This final action serves the double purpose of raising the temperature of the water which is to be used to feed the machine and of cooling the distilled water which has been produced in the machine.

It is vitally important that great care be taken in the design of the separators to see that no water is carried over with the steam, otherwise the purity of the distilled water produced would be vitiated.

In the diagram, fig. 3, the top vessel is shown in section, and the special arrangement to allow free expansion of the tubes is readily seen.

It will be noticed that this form of evaporator secruse the high rate of flow through the tubes which experiments show to be so desirable. Though 31 deg. F. per effect would appear to be the most favourable division, experience has shown that a rather larger temperature difference is advantageous in the last, or last two effects. Fig. 4 shows the general appearance of a Mirrlees Watson six-effect evaporator

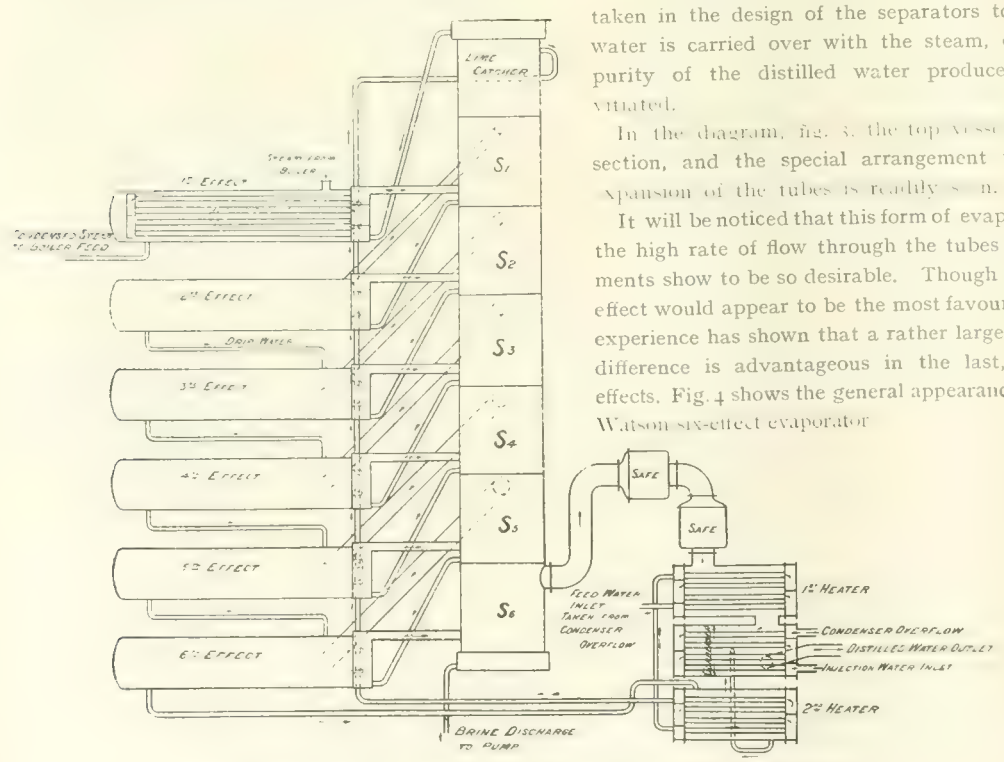


FIG. 3. SECTION OF SIX-EFFECT FRESH WATER EVAPORATOR.

SILK SPINNING MACHINERY.

At a meeting of the Leeds Association of Engineers, held on January 26th, the vice-president (Mr. W. H. Drake) occupying the chair, Mr. R. W. Crabtree delivered a lecture on Silk Spinning Machinery. In reality, said the lecturer, silk was spun by the insect, the use of machinery being for combing, dressing, twisting, etc. As a cocoon consisted of a single fibre gradually becoming thinner throughout its length, in twisting much skill was requisite in constantly adding to the six or seven strands commenced with to keep the thread equal. Mr. Crabtree exhibited a reel and spindle which did the twisting and winding of one operation at a speed of [illegible] revolutions per minute, and only required oiling once a month. Among other machines shown was a patent faller, much cheaper and three times as strong as an ordinary faller.

At the Society of Arts on Wednesday last, Sir William H. Preece, F.R.S., read a paper on the "Navigation of the Nile." He said that the works required to improve the navigation of the Nile were the removal of obstructive banks and shoals, the building of quays, the abolition of Shadufs and Sakias, the construction of training walls, and the development of new lands by the deposit of the silt. Thirty thousand tons of valuable mud were lost in the sea every year.

The Junior Institution of Engineers held its "coming of age" dinner at the Hotel Cecil on Saturday, January 14th. The president, Mr. W. H. Lindley, M.Inst.C.E., will occupy the chair.

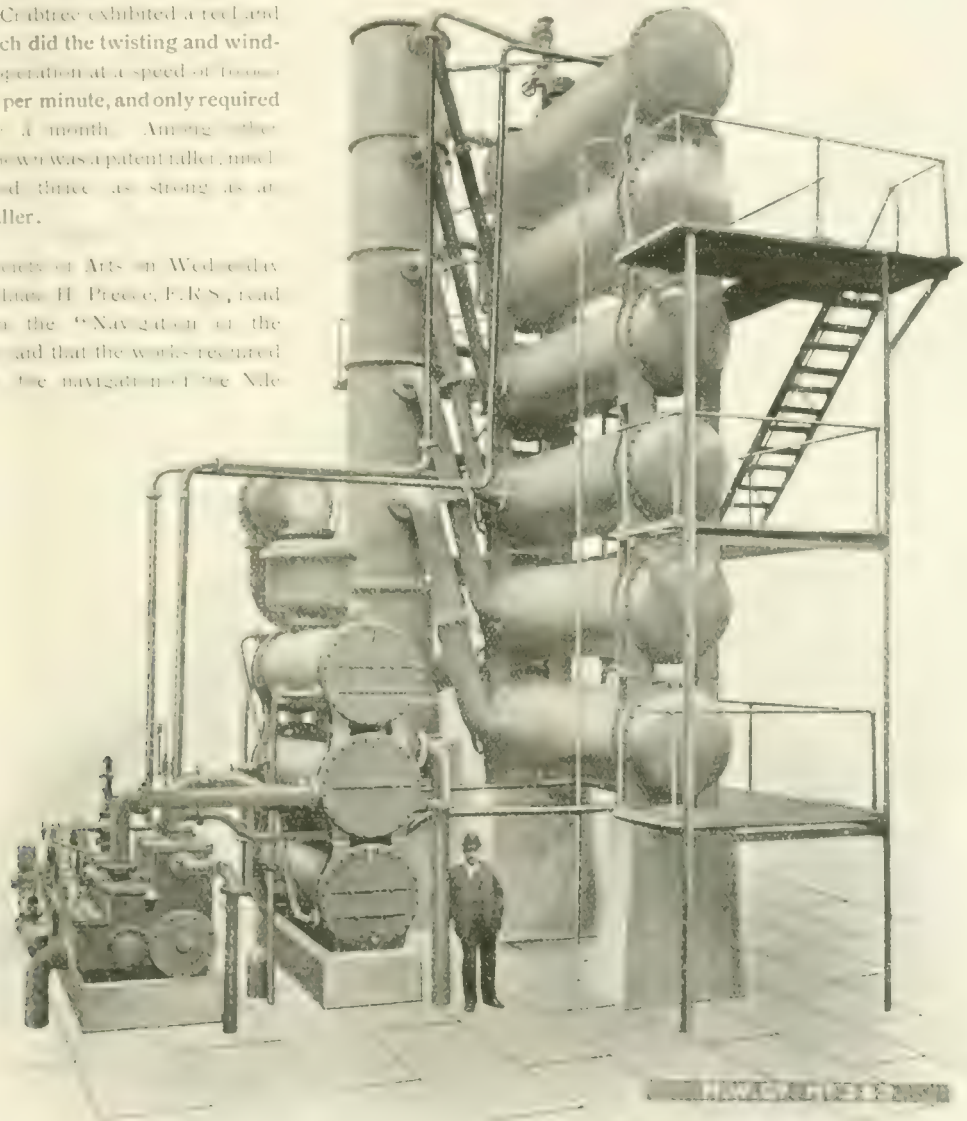


FIG. 4.—SIX-EFFECT EVAPORATOR BY MESSRS. MERRILLS, WATSON AND CO., LTD.

MASS ANALYSES OF MUNTZ'S METAL

A paper on this subject was read before the Faraday Society on Monday last by Mr. John G. A. Rhodin. The following is an abstract of the paper:—

Towards the end of 1903 the author was asked by the Muntz's Metal Company, Ltd., to devise a method of accurately determining the copper contents of Muntz's metal at such a speed as to enable the management to utilise the results in the ordinary course of manufacture. The difficulties were many, viz., the large number of analyses required, the extreme accuracy necessary, the necessity of working during the night as well as during the day, and finally the *condition sine qua non* that the results must be obtained within twelve hours of the time of casting. The author decided to adopt the electrolytic method, and having to deal with unusual current densities, decided to increase both the anode and cathode surfaces to the utmost limit compatible with moderate weight.

DESCRIPTION OF THE APPARATUS USED.

For this reason a fine platinum wire gauze was chosen as the material. Fig. 1 represents a pair of electrodes, *a* being the cathode, and *b* the anode. The anode, however, differs from most constructions by having a cylindrical

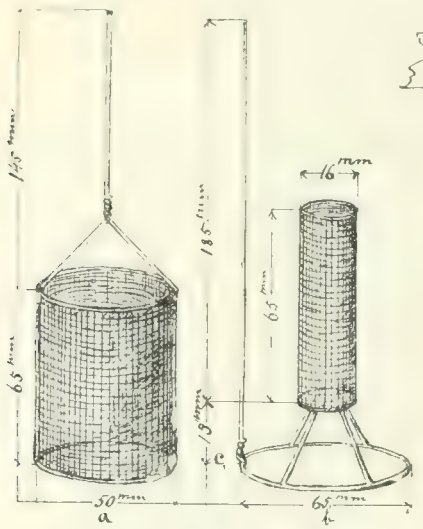


FIG. 1. PAIR OF ELECTRODES.

part of extensive surface, which, when in use, is concentric with the cathode. The pole wire of the anode is fastened to the bottom ring at *c*. By having the two points of maximum P.D. at the upper and at the lower end of each of two concentric electrodes, it may be assumed that the current distribution will be very even, as when such an arrangement is used, the P. D. between any two radically opposed points in any horizontal section is, theoretically and practically, everywhere the same. Secondly, the arrangement offers no obstacle to the rapid removal of the cathode. Fig. 2 shows a couple of these electrodes in use.

The process is the simplest one possible. One gramme of the alloy is dissolved in 20 c.c. nitric acid, 1·2 sp.g. and the solution is heated on a sand bath till the red fumes disappear. 300 c.c. of distilled water are afterwards added, and the beaker is put in its place on the electrolytic table. The electrodes are

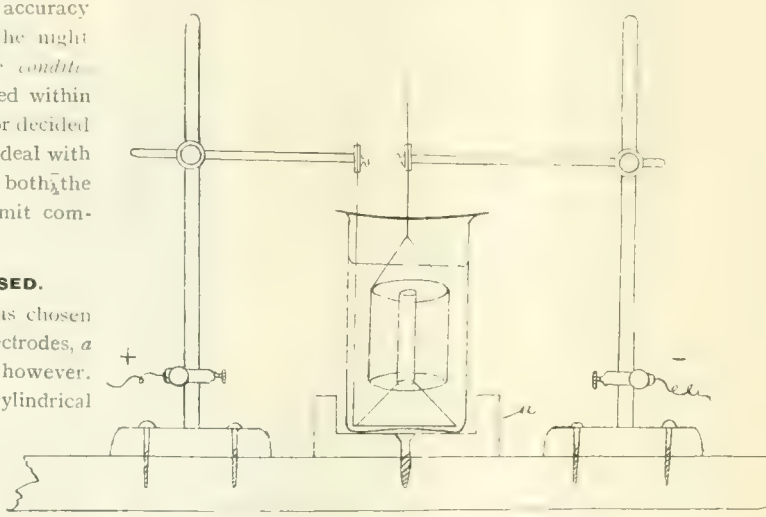


FIG. 2. SHOWING TWO OF THE ELECTRODES IN USE.

put in, and electrolysis is proceeded with. Two current densities are employed, viz., 0·5 amperes or 2·0 amperes. With the low current-density all the copper is deposited after twelve to fifteen hours and eventually it is cooled in the open air and weighed. With the high current-density, the time necessary for complete deposition of the copper is only three hours, and the deposit obtained is perfectly adherent to the cathode.

PHASES OF THE REACTION.

That the copper is fully deposited is patent from the the fact that the remaining solution gives no reaction for copper with any known re-agent. As a matter of fact one may distinguish between three distinct phases of the reaction: (1) Copper deposition and ammoniacal reduction of nitric acid; (2) ammoniacal reduction *per se*; (3) deposition of zinc in some form or another. It has very often been stated that the deposition of copper in the presence of zinc is incomplete, and many theoretical considerations would lend support to this statement. The author thinks however that

in the case under consideration where the overlapping phase 2 occupies a long time and is accompanied by metal deposition, a perfect separation is theoretically possible. Differences due to inherent analytical errors, and these arising from a possible lack of uniformity in the metal are extremely small. The practical utility of the analyses have led to greater accuracy in manufacture, the metal which has to be remelted being less than 3 per cent of the whole since the analytical control was established. The point is worth referring to in connection with the modern problem of manufacturing economy. Fig. 1 shows the main installation of twenty-five pairs, and gives a good idea of the external of the plant.

The author foreshadows the probable issue of a further research in connection with the electro-chemical properties of Muntz's metal. The metal is to a great extent, employed as sheathing for the protection of woodwork against the action of certain mollusca and algæ which breed in the sea. To be successful it must dissolve in sea water by electrolytic action to a sufficient extent to render the surface poisonous, but sufficiently slowly to make its use economical. The optimum must occur when the two constituents, copper and zinc, dissolve at exactly the same rates in which they occur in the alloy, during as great a part of the life of the plate as possible. By this means only the metal will remain of similar composition throughout its mass or the greater part thereof. That such a state of equilibrium is possible in the case of an alloy is in itself very interesting, and promises a future development of a very important nature, viz., an elucidation of the molecular work in alloys, and its subdivision in component parts. A further communication on this interesting subject is promised by the author.

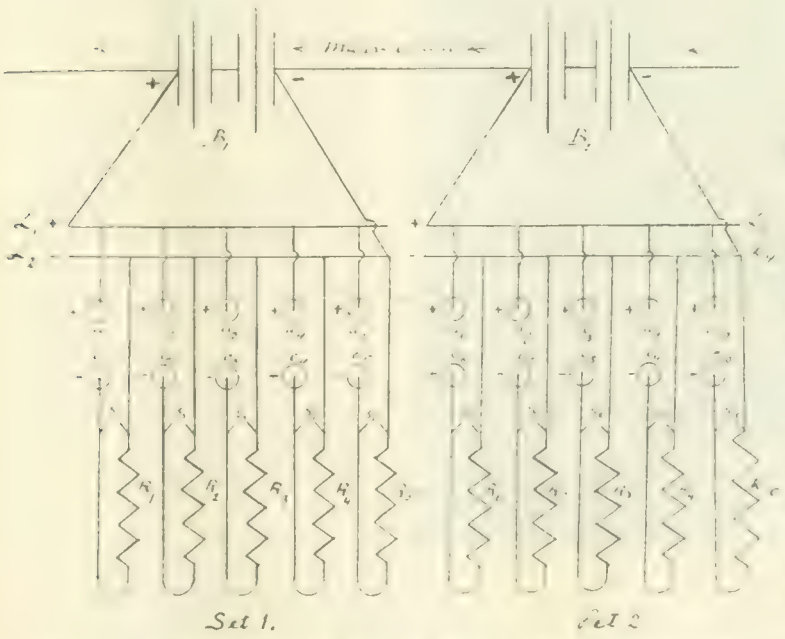


FIG. 2. DIAGRAM OF TWO SETS OF FIVE PAIRS OF ELEMENTS.

HYDRAULIC PRESSING, STAMPING AND FORGING MACHINERY.

A paper on this subject was read before the Liverpool Engineering Society by Mr. J. W. Steele on the 25th January.

The designing of an hydraulic press with its complete plant is a matter requiring careful consideration, especially in an installation running into thousands of pounds.

It is essential that the installation should be so designed that the work to be done should be produced at a minimum of labour and cost. Every part should be carefully considered so that the pattern-maker, moulder, smith, machinist and erector should have the minimum of labour in constructing it. Complicated brackets, difficult forgings and machining is very often the cause of enhanced cost of production of the plant. An important point is to see that the material used is distributed to the best advantage, the breaking strain of the material being known, the experienced designer knows the safe limit of stress to allow.

This very much depends upon the nature of the machine, that is to say, whether it is slow working or quick working, of the column type or open gap type. For instance in an ordinary four column press, with tables of cast iron, 1¼ tons per square inch stress may be allowed in tension and 2 tons per square inch in compression, with the material to stand the usual test. In a gap machine such a stress would be much lower in tension and compression. In cast steel the stress is much greater the tension and compression being the same, 5 tons per square inch for tension and compression in a column machine and 3 tons per square inch for open gap machines. It is not advisable to take these figures for all circumstances, as conditions vary with centres of columns and

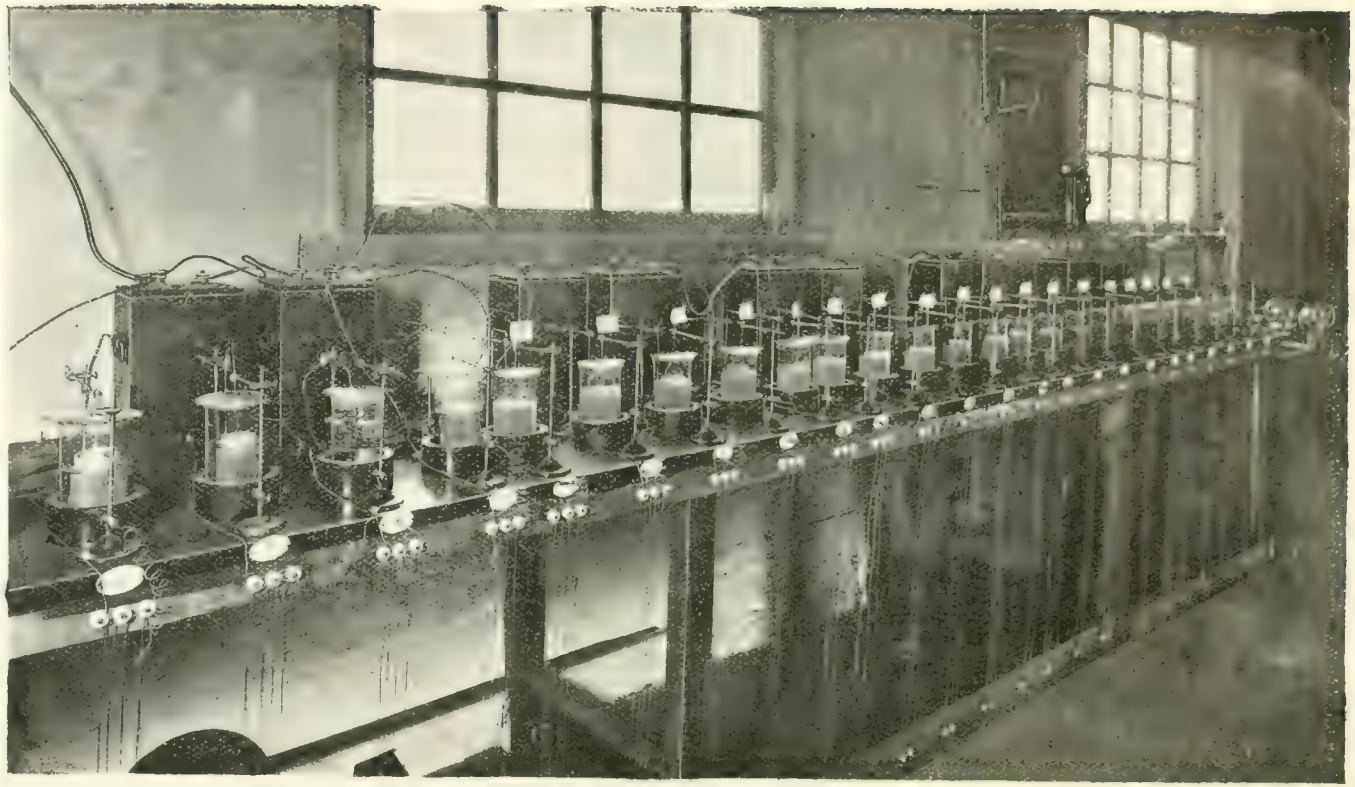


FIG. 4. MAIN INSTALLATION OF PAIRS OF ELECTRODES USED IN MASS ANALYSES OF MUNTZ'S METAL.

methods of working, also steel by different makers varies in its ultimate breaking strain.

Assuming that the power of the press is settled there is next to be considered the method of load, which will determine the bending moment from which is obtained the amount of material required to take the stress.

The depth of the girder is a most important matter to consider; greatest depth means greatest moment of inertia and least weight.

The flange of cylinder requires to be strong enough to take the shear, and of sufficient width for crushing strain; this latter point is sometimes neglected with disastrous results. The open gap type of machine is usually adopted for hydraulic punching, shearing, forging, and welding presses up to 300 tons power.

Although the design of every part of a press is of importance, none is more so than the operating valves.

(To be continued.)

CONTRACTORS' NEWS.

We shall be pleased to insert under this column, free of charge, particulars of open contracts.

CONTRACTS OPEN.

	Last Day
G.W. & Midland Railways.—Erection of corrugated footbridge at Oddington, near Stapleness. Engineer, Paddington Station, W.	Feb. 6
Ilford. Supply of 2,500 yds. of 4-m. concentric armoured cable. Electrical Engineer, Electricity Works, Ley Street, Ilford	Feb. 7
Widnes.—Sinking two bore-holes at Stocks Wells Pumping Station. Mr. Isaac Carr, Engineer, Widnes	Feb. 7
Brusssels.—Establishment of a central electric lighting station at the new goods station near the Brussel Dock for Belgium State Railways. Particulars at La Bourse Brussels	Feb. 8
West Ham. Supply of engine, coal stoves, cable, integrating wall meters, etc. Borough Electrical Engineering Central Station, Tucker-street, Canning Town ...	Feb. 9
Ghent. Supply of fifteen electric cranes for use in connection with the docks. Hotel de Ville, Ghent	Feb. 13
Bury.—Supply and erection of one 500 k.w. direct-current high-speed generating set. Mr. S. J. Watson, Electricity Works, Bury	Feb. 14
Lagos.—The Crown Agents for the Colonies invite tenders for the supply of steel rails, fish-plates, and steel sleepers for thirty miles of single track. Crown Agents' Office, Whitehall Gardens, S.W.	Feb. 14
Merthyr Tydvil.—Supply of between 5,700 and 6,000 tons of cast-iron pipes for high-level aqueduct, valves, etc. Mr. George F. Deacon, 16, Great George Street, Westminster, S.W. or Clerk, Town Hall, Merthyr Tydvil	Feb. 15
Bournemouth.—Three contracts in connection with tramways: (a) Steel grooved girder rails; (b) permanent-way construction and rail bonding; (c) wood blocks and granite at edging. Mr. F. W. Lacey, Borough Engineer, Bournemouth	Feb. 15
Copenhagen. Supply and erection of gasometer of a capacity of 2,000,000 cubic feet per hour for the Lighting Department of the Corporation. Valby Gasworks, Valby, Copenhagen	Feb. 27
Barcelona.—The "Gaceta de Madrid" of January 18th contains a notice calling for tenders for the supply and installation in the sheds of the Barceloneta wharf of two transhipment cars for platform cranes. Conditions of contract and plans may be inspected at the offices of the Secretary of the Port Administration, Casa Lonja, Barcelona	March 1
Johannesburg. Supply of two electric cars, two electric water cars, five-ton crane car traverser, and workshop tools for Municipal Council	March 6
Belgium. The "Bulletin Commercial" announces that the Belgian State Railways invite tenders for the installation of two sets of ventilating and heating apparatus in the central workshops at Mechlin. Particulars of M. Slaghmuylder, Engineer-in-chief, Station du Nord, Brussels ...	March 6 March 13
Madagascar. Plant and machinery are required for the establishment of a pumping station at Majunga, Madagascar. Particulars may be obtained from the Minister of the Colonies, 4, Rue Jean Nicot, Paris	—
Chile. News has been received at the Commercial Intelligence Branch of the Board of Trade from the British Vice Consul, at Santiago (Mr. A. C. Kerr), notifying that tenders for the Valparaiso harbour works will be opened in April, 1906. Specifications will be sent to the various Chilian Legations in Europe and the United States	Apr. 1906

COMING CONTRACTS.

Cape Colony.—The Cape of Good Hope Government Gazette of December 30th notifies the intention of the Town Council of Somerset East to proceed with the raising of a loan of £10,000 for the purpose of carrying out the new water scheme passed by public meeting.

Natal. — The Natal Government Gazette of December 13th contains notices of applications for leave to introduce Bills into the Legislative Assembly of Natal to authorise the construction and working of tramways either by electricity or other power. The Gazette may be seen at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, E.C.

Gorton. The District Council is seeking powers to construct tramways (single track with passing places) from the Manchester city boundary, along Gorton Lane and Wellington Street to Hyde Road, and from Hyde Road along Reddish Lane to the boundary of the Gorton Urban District.

China. The "Dépêche Coloniale" states that a railway from Nanchwang to Kiukiang is about to be constructed at a cost of 4,000,000 taels (one tael = between 5s. 6d. and 6s.), half of this sum will be subscribed by natives in Kiangsi, and the remainder will be met by a subsidy from the Government.

West Ham.—The Board of Trade has sanctioned the borrowing of the following sums for electrifying the High Street, Romford Road, and Leytonstone Road lines of tramway: £20,850 for the permanent way, £10,000 for electrical equipment, and £18,550 for the provision of cars.

Italy.—A company has just been formed in Brussels with a capital of £50,000, to be known as La Compagnie Italo Belge des Tramways Electriques de Verona, to construct and work a system of electric tramways in the town of Verona. The object of the company is to acquire the tramways, about 4 km. in length, in the town of Verona and convert the same to electric traction on the overhead system and to construct further 4 km. of lines.

CONTRACTS CLOSED.

Perth.—The British Electric Plant Company, Ltd., of Alloa, informs us that it has been awarded the contract by the Perth Corporation for a 500-kilowatt compound traction generator, together with engine for the same, the combined set having an overload capacity of 600 kilowatts.

Erith.—Messrs. Mountain and Gibson, of Bury, inform us that they have secured the contract from the Erith District Council for fourteen of their electric motor-trucks for tramways, and for one sweeping and watering car.

Bury.—The Holwell Iron Company, Ltd., of Ashford by Melton Mowbray, has secured the order for the cast-iron pipes required for Contract No. 1 of the Bury and District Joint Water Board, Lancs.

New York.—The New York Central and Hudson River Railroad Company has placed an order with the General Electric Company, of New York, for 60,000 h.p. in Curtis steam turbo-alternators, consisting of eight units of 7,500 h.p. each. This will be, when completed, the largest steam-turbine installation of any kind in the world.

Birkenhead. The Frammere Bay Development Company, Ltd., Birkenhead, have placed a contract with the Power-Gas Corporation, Ltd., for a gas-driven electric installation for their new shipyard at Birkenhead. The installation consists of a power-gas plant of 6,000 h.p. capacity. The electric generating plant comprises two 400 i.h.p. Premier gas engines, each direct coupled to a Bruce-Peebles 220 kw. dynamo, and three 250 i.h.p. Premier gas engines, each direct coupled to a Bruce-Peebles 140 kw. dynamo.

Maritzburg.—Tenders for the additional generating plant required for the Maritzburg tramways have been under consideration by the Town Council. The acceptance is recommended of Messrs. Collins, Kessler and Co.'s tender for a Williams and Robinson-Parker 250 k.w. traction set for the sum of £2,161.

London.—The Brush Electrical Engineering Company has been awarded the following contracts: 18 double-deck car-bodies, with Brush trucks and equipment for Leith Corporation; power-house plant, consisting of three 400 kw. steam turbo-generators, condenser, pumps, pipe-work, etc., for Port Elizabeth.

Belfast.—Messrs. Combe Barbour are building three vertical triple high-speed engines of the enclosed type for the Belfast Tramway Power Station for direct coupling to Westinghouse generators. Each engine will develop 1,550 B.H.P. at 180 revolutions.

Bury.—Messrs. Mountain and Gibson have secured the contract from the Bury Council for fourteen M. G. 21 E. M. electric motor trucks for tramways, and for one sweeping and watering car mounted upon one M. G. 21 E. M. tramway truck.

Glasgow.—Messrs. Connal and Co., Ltd., of Glasgow, have placed with Messrs. A. and J. Main and Co., Ltd., of Possilpark, for the erection on their ground at Mavisbank Quay, Glasgow, of a large iron shed for the storage of goods.

London County Council.—The London County Council have placed an order for a powerful motor steam fire-engine for the London Fire Brigade with Messrs. Merryweather and Sons, Ltd. It will be capable of delivering 500 gallons per minute, using oil fuel, and be able to turn out under full steam in sixty seconds from a call.

Transvaal. Among recent orders secured by the Worthington Pump Co. for condensing machinery, is one for a large cooling-tower plant for the Premier (Transvaal) Diamond Mining Company.

APPOINTMENTS VACANT.

	Last Day
East Indian Railway.—Assistant locomotive superintendent. Salary Rs. 350 rising to Rs. 400 per calendar month. Mr. C. W. Young, Secretary, 28, Nicholas Lane, E.C.	Feb. 11
India Office.—Assistant engineers in the permanent establishment of the Indian Public Works' Department. Secretary, Public Department, India Office, Whitehall, S.W.	May 1
West Bromwich.—Assistant electrical engineer at an initial salary of £120 per annum. Mr. John H. Wray, Electricity Works, West Bromwich	Feb. 4
Birmingham.—Chemist to take charge of a new 20-ton per diem coal-testing plant, fitted with regenerative retort settings. Chairman of Works, Sub-Committee of Gas Department, Council House, Birmingham	Feb. 20
City Corporation.—Mr. D. J. Ross, engineer and surveyor to the City Corporation, is retiring on account of ill-health. At a joint meeting of the Officers and Clerks, the Finance and the Improvements committees, it was decided to advertise for a successor. The salary was fixed at £1,500, rising to £2,000. Candidates must not be over fifty years of age	—

APPOINTMENTS FILLED.

Indian Railway Board.—Mr. Walter H. Wood, general manager of the Hull and Barnsley Railway, has been appointed the English member of the new Indian Railway Board, whose numbers are now complete.

Chesterfield.—Mr. R. L. Acland has been appointed to the joint offices of electrical engineer and manager of the Chesterfield tramways department at an initial salary of £350 per annum.

Johannesburg.—Mr. Leitch, formerly town engineer at Johannesburg, has been appointed Consulting Civil Engineer to the Council at a fee of £500 per annum. The appointment is subject to the approval of the Rand Water Board.

India. — Mr. Frank Cartwright, A.M.Inst. C.E., has been recommended by the Government of Bombay for the post of State Engineer to His Highness the Maharajah of Rewa.

Northampton Institute.—Mr. H. M. Hobart has been appointed lecturer in electrical engineering design at the Northampton Institute, Clerkenwell, in succession to Mr. E. Kilburn Scott, who has been appointed lecturer in electrical engineering in the University of Sydney. Mr. M. Holroyd Smith has been appointed chief assistant in the mechanical engineering department at the same Institute, in succession to Mr. W. E. Curnock, who has been appointed head of the mechanical engineering department of the Technical College, Huddersfield.

Brighton.—Mr. M. H. Volk, who has just resigned his position as works engineer to the Brighton Corporation tramways department, is about to take up an appointment as engineer and manager to the Brighton Beach electric railway.

Share List of Engineering, Electrical, Iron and Steel, and other Companies.

The following is a comprehensive list of Companies in the industries covered by "Page's Weekly," in which shares business is being currently transacted. Additions will be made from time to time as occasion requires. We desire it to be understood that while our Share List will generally be found correct, we do not hold ourselves responsible for any loss or inconvenience that may arise from possible inaccuracies

STOCK EXCHANGE SETTLING DAYS.—Settling days on the Stock Exchange are as follows :—

Consols: February 1st. General Settlements: February 10th, 24th, March 15th. Bank Rate, April 21st, 1904, 3 per cent

I.—ENGINEERING, IRON, AND STEEL COMPANIES.

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices
11,370	5	5/-	Alldays & Onions Pneumatic Engineering, Ltd.	3	2⅛ — 3
10,000	5	3/-	Do. Cum. Pref. 6 per cent.	5	4½ 5
3,210,000	1	2/6	Armstrong (Sir W. G.), Whitworth and Co., Ltd.	1	3⅛ — 3⅛
76,970	5	2/-	Do. 4% Cum. Pref.	5	5⅛ — 5⅜
1,500,000	100	4/-	Do. 4% 1st Mort. Dbs. Rd.	100	102 — 104
£100,000	100	4½%	Aveling and Porter, Ltd., 4½% Reg Mt Debs. Red.	100	96 — 99
530,000	1	1/7½	Babcock and Wilcox, Ltd., Ord	1	3⅛ — 3⅜
100,000	1	7½d.	Do. 6% Cum. Pref.	1	1½ — 1⅝
20,000	5	3/-	Baker (Joseph) and Sons, Ltd. 6% Cum. Pref.	5	5 — 5½
250,000	1	6¾d.	Baldwins, Ltd., 5½% Cum. Pref.	1	1 — 1⅛
£250,000	Stk	4½%	Do. 1st Mt. 4½% Deb. Stk. Red.	100	101 — 103
150,000	4½	2/8½	Barrow Hæmatite Steel Co., Ld., O.	4½	1⅞ — 1¾
50,000	4½	6/-	Do. do. Cum 2nd. Pref.	4½	4¼ — 4½
34,334	5	2/6	Bayliss, Jones and Bayliss, Ltd., 5% Cum. Pref. Shares	5	4½ — 5½
£500,000	100	—	Beardmore (Wm.) & Co., Ltd., 4½% 1st Mt. Debs., Red., Scrip 50 pd		100 —102
50,000	10	6/-	Bell Brothers, Ltd., 6% Cum. Pref.	10	11½ — 12/-
£366,600	Stk	4%	Do 4% Deb. Stock, Red	100	99 101
149,850	1	6d.	Bengal Iron and Steel Ord.	1	1 — 1⅛
200,000	1	1/-	Beyer, Peacock and Co., Ltd., Ord.	1	⅞ — 1
300,000	1	6¾d.	Do. 5½% Cum Pref.	1	⅞ — ⅞
£300,000	Stk	4½%	Do. 4½% Red. Deb. Stock	100	94 — 97
1,629,760	1	6d.	Bolckow, Vaughan and Co., Ltd., O Nos. 1 1,629,760	1	1 — 1⅛
1,860,900	1	3¾d.	Do. Nos. 1,639,101-3,500,000	12/-	⅝ — ¾
1,160,000	1	4½d.	Brown (John) and Co., Lim., Ord., Nos. 1 1,160,000	15/-	1⅛ — 1⅜
590,000	1	6d.	Do. Ord., Nos. 1,160,001-1,750,000	1	1⅛ — 1⅛
74,000	10	5/-	Do. 5% Cum. Pref.	10	11½ 11¾
154,500	5	2/6	Cammell, Laird & Co., Ltd., Ord.	5	8⅞ — 9¼
232,500	5	2/6	Do. 5% Cum. Pref.	5	5⅛ — 5⅜
450,000	1	1/6	Clayton & Shuttleworth, Ltd., Ord.	1	1⅛ — 1⅜
70,000	5	2/6	Do. 5% Cum. Pref.	5	5¼ — 5½
£2,500,000	Stk	4%	Do 4% 1st Mort Db. Stk. Red	100	100 102
100,000	10	30/-	Consett Iron Co., Ltd., Ord.	7½	33 35
57,681	10	10/-	Crossley, Bros., Ltd., Ord. 40,340,97,370	10	15⅞ 16½
40,839	10	5/-	Do 5% Cum Pref.	10	11¼ 11⅜
75,000	1	2/6	Delta Metal, Ltd. Shares	1	2 2½
1,259,594	1	3/6d.	Dorman, Long & Co., Ltd.	1	⅝ ¾
£400,000	Stk	4%	Do. 4% 1st Mort. Perp. Deb. Stk	100	90 — 93
£250,000	Stk	—	Do. 6% 2nd Mort. Deb. Stk., Red.	—	94 — 96
200,000	5	3/-	Dunderland Iron Ore Co., Ltd., 6% Cum. Pref. and Participating	5	3 — 3⅜
250,000	1	9¾d.	Dunlop (James) & Co., Ltd., Ord.	1	⅝ — ¾
800,000	1	7½d.	Do. 6% Cum. Pref.	1	⅝ — 1⅛
4,721	13	12/-	Ebbw Vale Steel, Iron & Coal Co., Ltd.	13	9 10
69,754	13	12/-	Do. do. do.	10	7⅛ 8⅛
20,250	10	8/-	Elliott's Metal, Ltd.	8	4½ 5⅛
5,000	10	5/-	Do. Cum. Pref. 5%	10	8½ 9½
186,748	Stk	4%	Do. Deb 4%	100	94½ 96½
25,000	10	6/-	Fairfield Shipbuilding & Engng. Co., Ltd., 6% Cum. Pref.	10	10½ — 11
£250,000	Stk	4½%	Do. 4½% Mort. Deb. Stk. Red.	100	97 100
9,000	10	10/-	Fleming & Ferguson, Ltd. Ord Nos. 1 to 9000	10	12 12½
6,000	10	5/-	Do 5% Cum Pref Nos. 9001/15000	10	9⅛ 9½
126,000	3	3/-	Fraser & Chalmers, Ltd., Ord	3	4⅜ 4⅝
21,000	3	1/6	Do. 7½% Cum. Pref.	3	5½ 6
10,000	10	5/-	Galloways, Ltd., 5% Cum. Pref 1891/2/8000	10	6 — 7
£150,000	Stk	4%	Do 4% 1st Mort Deb Red	100	89½ 91½
265,000	1	1/-	Guest, Keen & Nettlefolds, Ltd. Ord.	1	2⅛ — 2⅜
344,000	5	2/6	Do. 5% Cum. Pref.	5	5⅞ — 6⅛
£1,850,500	Stk	4%	Do. 4% Irred. Mort. Deb. Stk.	100	105 107
13,000	5	2/6	Gwynnes, Ltd., 5% Cum. Pref.	5	2 3
250,000	1	1/-	Hadfield's Steel F'dry Co., Ld., Ord.	1	3⅛ — 3⅜
20,000	10	4/6	Do. 4½% Cum. Pref.	10	10½ — 11
20,000	5	3/-	Hall (J. & E.), Ltd. 6% Cum. Pref.	5	5 5⅛
408,595	1	1/6	Harvey United Steel Co., Ltd.	1	1⅜ 1⅝
47,500	10	7½	Hawthorn, Leslie & Co., Ltd. Ord.	10	11 11½
28,001	5	7/-	Head, Wrightson & Co., Ltd.	5	4⅞ — 5
85,000	1	7¾d.	Hill, Richards & Co. (1896) Ld., Ord.	1	⅝ — ¾
18,000	5	3/-	Do. 6% Cum. Pref.	5	4⅞ — 5
30,000	10	6/-	Hornsby (Richard) & Sons, Ld., Ord.	8	5⅞ — 6⅛

ENGINEERING, IRON, AND STEEL COMPANIES.—*Contd.*

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices
750,000	1	6d.	Howard & Bullough, Ltd., Ord.	1	1⅛ —1¼
25,000	10	6/-	Do. 6% Pref. Non-Cum.	10	12¼ 12½
£250,000	Stk	4%	Do. 4% Deb. Stk., Red. after 1905	100	98 —101
87,500	10	20	Kynoch, Ltd.	10	19 20
49,537	10	5%	Do. Cum. Pref. 5%	10	10⅝ 11⅛
300,000	1	4½d	Lambert Bros., Ltd., Ord.	1	⅝ — ¾
50,000	5	2/9	Do 5½% Cum. Pref.	5	4 — 4½
40,000	3	2/1½	Leeds Forge Co., 7% Cum. Pref.	3	3¼ — 3½
200,000	1	7½d.	Lysaght (John), Ltd., 6% Cum. Pf.	1	1⅛ — 1⅛
£300,000	Stk	4½%	Do 4½% 1st Mt. Deb. Stk., Red.	100	108 110
40,000	10	5/-	Mather & Platt, Ltd., 5% Cum. Pref	10	11 11½
210,000	1	6d.	Measures Bros., Ltd., Ord.	1	⅜ ½
75,000	1	6¾d.	Do. 5½% Cum. Pref.	1	½ ⅝
£75,000	Stk	4½%	Do. 4½% 1st Mrt. Db. Stk., Red.	100	96 99
21,913	5	2/6	Muntz Metal, Ltd.	5	5 5⅛
14,248	5	5%	Do. Pref. 5%	5	5⅛ — 5⅜
5,000	62½	17/6	Nantyglo and Blaina Iron Works, Ltd., 8% Cum. Pref	62½	74 76
73,000	10	5/-	N. Brit. Loco. Co., Ltd., 5% Cm. Pf.	10	11¼ 12
80,000	5	—	North-Eastern Steel Co., Ltd., Ord.	5	— —
£250,000	Stk	4½%	Do. 4½% 1st Mrt. Db. Stk., Red.	100	90 93
122,000	5	2	Pearson & Knowles Coal and Iron Co., Ltd., Ord., "B"	5	3⅜ — 4
50,000	5	3/-	Do. 6% Cum. Pref. "A"	5	5⅛ 6⅛
70,000	10	6/-	Pease & Partners, Ltd., Ord.	10	9½ 10
£400,000	Stk	4%	Do. 4% Perp. Deb. Stock	100	97 100
20,000	5	3/-	Peebles(Bruce) & Co., Ltd., 6% Cm. P	5	4¼ 5
65,000	1	—	Pooley (Henry) & Son., Ltd., Ord	1	3/ 4/
13,000	5		Do. 5% Cum Pref.	5	2⅞ 3
230,000	1		Projectile Co. (1902), Ltd., Ord.	1	⅝ ¾
126,938	5	2/-	Rhymney Iron Co., Ltd.	5	1⅞ - 2
74,062	5	2/-	Do. New	5	1¼ 1⅜
£330,000	—	5%	Do. 5% Mort. Deb., Red.	100	99 —102
350,000	1	7½d.	Richardsons, Westgarth & Co., Ltd., 6% Cum. Pf.	1	⅞ 1
£350,000	Stk	4½%	Do. 4½% Perp. Deb. Stock	100	95 97
35,000	10	12/-	Ruston, Proctor & Co., Ltd.	10	9¼ 9⅝
275,000	1	6d.	Scott (Walter), Ltd., Ord.	1	⅝ 1
300,000	1	7½d.	Do. 6% Cum. Pref.	1	1 — 1⅛
£300,000	Stk	4%	Do. 4% Perp. Deb. Stk.	100	94 — 96
£115,300	100	5%	Shelton Iron Steel and Coal Co., Ld. 1st Charge 5% Debs., Red	100	90 93
£97,900	100	6%	Do. 6% 2nd Mort. Debs., Red.	100	91 — 95
250,000	1	1/-	South Durham Steel & Iron, Ltd. Or.	1	⅝ ¾
300,000	1	7½d	Do. 6% Cum. Pref.	1	½ ⅝
£300,000	Stk	4½%	Do. 4½% Per. Deb. Stock	100	89 — 92
49,760	10	2½	Steel Co of Scotland Ord 1/49560	9	5⅝ 5⅞
£125,240	Stk		Do. 5% Trust Mort. Deb	100	106⅛—107½
25,000	10	—	Stephenson (Robert) & Co., Ltd., Or.	10	2 2½
25,000	10	5,6	Do. 5½% Cum. Pref.	10	1½ 1⅝
£250,000	Stk	4%	Do. 4% Perp. Deb. Stock	100	76 78
85,000	10	9/-	Stewarts & Lloyds, Ltd., Ord.	10	17⅞— 18
55,000	10	6/-	Do. 6% Cum. Pref	10	14½ 14¾
634,732	1	1.69d.	Swan, Hunter & Wigham-Richardson, Lim. Ord.	1	⅝ 1
538,845	1	6d.	Do. 5% Cum. Pref	1	⅝ 1
£240,000	Stk	4½%	Do. 4½% 1st Mort. Deb. Stk. Red	100	98 101
300,000	1	6d.	Thames Iron Works, Shipbuilding & Engineering Co., Ltd., 5% Cum. Pf.	1	½ ⅝
£200,000	100	4%	Do. 4% Irredeem. 1st Mort. Deb.	100	67 71
£160,000	1	7½d.	Thornycroft (John I.) & Co., Ltd. 6% Cum. Pref	1	⅝ 1⅛
10,000	10	5/-	Tylor (J.) & Sons, Ltd. 5% Cum. Pf.	10	9½ 10
$508,495,200	$100	8½	United States Steel Corp. Com. Stk.	$100	31 31½
$360,314,100	$100	8½	Do. 7% Cum. Pref. Stock	$100	96½ 97
$162,268,000	$1000	5%	Do. 10-60 yr. 5% Skg. Fd. G. Bds.	$1000	96 — 98
$350,000	1	1%	Vickers, Sons & Maxim, Ltd. Ord.	1	2⅜ 2⅝
750,000	1	6d.	Do. 5% Non-Cum. Pref.	1	1⅜ 1⅝
£750,000	Stk	5%	Do. 5% Non-Cum. Pref. Stock.	100	114 —117
£1,250,000	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red.	100	105 —107
£1,000,000	100	4%	Do. 4% 2nd Mort. Debs., Red.	100	104 106
225,000	1	1/-	Wear Gas Steel, Coal & Coke, Ltd., Def. Ord.	1	⅝ ¾
500,000	1	7½d	Do. 6% Cum. Pref. Ord.	1	⅝ 1
£300,000	Stk	4%	Do. 4% Perpetual Deb. Stock	100	85 90
7,687	5	2/-	Webb's Steel Tube, Ltd., Cum. Pref. 5%	5	4⅞ — 4⅞
300	Stk	4½%	Do. Mort. Deb. 4%	100	91 97
66,666	5	3/-	Whites & Robertson, Ord.	5	1 —
60,000	5	4%	Do. 6% Cum. Pref.	5	3 4
£246,641	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red	100	74 — 79
£150,000	Stk	4½%	Yorkshire Iron & Coal Co., Ltd. 4½% 1st Mort. Deb. Stk. Red.	100	81 —

Stocks and Shares marked * are quoted ex-dividend.

II.—ELECTRICAL MANUFACTURING COMPANIES.

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices.
70,000	1	6d.	Alliance Elec. Co., Ltd. 5% Cum. Pf.	1	⅜ — ½
125,000	1	7½d.	Aron Elec. Meter Ltd., 6% Cum Pf.	1	⅝ — ¾
120,000	1	9d.	Bell's Asbestos Co., Ltd. ..	1	1⅛ — 1⅜
100,000	5	1/-	British Insulated & Helsby Cables Ltd., Ord. ..	5	5¼ — 5⅜
100,000	5	3/-	Do. 6% Cum. Pref	5	5 5¼
£500,000	Stk	4½	Do. 4½ 1st Mort. Deb. Stk. Rd.	100	101 — 104
£200,000	Stk	4½	British Thomson-Houston Co., Ltd., 4½% 1st Mort. Deb. Stk. Red. ..	100	101 103
400,000	5	3/-	British Westinghouse Electric and Manufac. Co., Ltd., 8% Pref. ..	5	2⅝ — 2⅞
£616,333	Stk	4%	Do. 4% Mort. Deb. Stk. Red...	100	86 88
105,731	2	2/-	Brush Elec. Engng. Co., Ltd., Ord..	2	½ — ¾
150,000	2	2 4½	Do. 6% Pref.	2	1¼ — 1½
£125,000	Stk	4½	Do. 4½% Perp. 1st Deb. Stk...	100	93 — 96
£125,000	Stk	4½	Do. 4½% Perp. 2nd Deb. Stk.	100	74 — 77
35,000	5	5/-	Callender's Cable & Constn. Ltd. Ord.	5	9½ - 10
40,000	5	2/6	Do. 5% Cum. Pref.	5	5⅛ 5⅜
£200,000	Stk	4½	Do. 4½% 1st Mort. Deb Stk. Red.	100	104 — 106
85,000	3	1/6	Crompton & Co., Ltd...	3	2¼ — 2½
£100,000		5%	Do. 5% 1st Mort. Reg. Debs.	100	93 — 98
52,000	5	10/-	Dick, Kerr & Co., Ltd., Ord. ..	5	8 - 8½
61,000	5	8 -	Do. 6% Cum. Pref.	5	5⅝ — 6
£300,000	Stk	4½%	Do. 4½% Deb. Stock, Red. ..	100	105 107
233,334	1	6d.	Doulton & Co., Ltd., 5% Cum. Pref.	1	1⅛ 1⅜
£233,334	Stk	4%	Do. 1st Mort. 4% Iree. Deb. Stk.	100	105 —108
99,261	5	1/6	Edison and Swan United Electric Light, Ltd., "A" Shares Nos. 1-99,261	3	⅝ — ¾
17,139	5	2/6	Do. "A" Shares Nos. 01-017,139	5	1 — 1⅛
£344,023	Stk	4%	Do. 4% Deb. Stock Red. ..	100	77 — 82
£100,000	Stk	5%	Do. 5% Second Deb. Stk. Red.	100	79 — 84
112,100	2	1 7½	Electric Construction Co., Ltd. ..	2	1⅜ — 1½
31,390	2	2 9½	Do. 7% Cumulative Pref. ..	2	2¼ — 2⅜
£200,000	Stk	4%	Do. 4% Perp. 1st Mt. Deb. Stk.	100	97 99⅝
10,248	10	7/6	Evered and Co., Ltd.	10	13 — 15
£100,000	Stk	5%	Ferranti, Ltd., 5% 1st Mort. Deb. Stock, Red.	100	90 — 95
25,000	10	5/-	Gen. Elect. Co. (1900), Ltd., 5% Cum. Pref.	10	9⅛ — 10
£200,000	Stk	4%	Do. 4% 1st. Mt. Deb. Stk., Red.	100	91 — 96
35,000	5	5/-	Henley's (W. T.) Telegraph Works Co., Ltd., Ord.	5	10½ — 11
35,000	5	2/3	Do. 4½% Cum. Pref.	5	5⅜ — 5⅝
£50,000	Stk	4½%	Do. 4½% Mt. Deb. Stk. Red.	100	110 —112
50,000	10	5/-	India Rubber, Gutta Percha & Telegraph Works Co., Ltd.,	10	15 16
£300,000	100	4%	Do. 1st Mort. Deb. Red. ..	100	99 —102
7,500	10	—	Parker, Thos., Ltd.	10	6½ — 7
100,000	1	3%	Scott (Ernest) & Mountain, Ld., Ord.	1	16/—16/6
37,350	12	12/-	Telegraph Construction and Maintenance Co., Ltd.	12	38 — 40
£150,000	100	4%	Do. 4% Deb. Bonds	100	101½-103½

III.—ELECTRIC TRACTION.

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices.
120,000	5	3/-	Anglo-Argentine Trams Co., Ld., Or.	5	8¼ — 8⅝
260,007	5	2/6	Do. 5% Cum Pf.	5	5⅜ — 5⅝
£230,000	Stk	6%	Do. Permanent 6% Debenture Stock, 1888 ..	100	140 —143
20,000	10	6/-	Barcelona Trams Co., Ltd., Ord. ..	10	12 — 12½
10,000	10	5/-	Do. 5% Cum Pf. Shares	10	9 — 10
£16 300	100	5%	Do. 5% Debs., Red. ..	100	99 —102
£191,326	Stk	4½%	Do. 4½% Red. Deb. Stk.	100	96 —100
75,606	1	—	Bath Elec. Trams. Ld., Pf. Or. ..	1	1¼ — 1⅜
59,394	1	11·49d	Do. 5% Cum. Pf. ..	1	1⅛ — 1⅛
75,000	5	—	Brisbane Electric Tram Investment Co., Ltd., Ord... ..	5	1⅜ — 1½
75,000	5	2/6	Do. 5% Cum. Pf. ..	5	3⅝ — 4⅛
£425,000	Stk	4½%	Do. 4½% 1st Deb. Stk., Red.	100	94 —98
£200,000	Stk	6%	Brit. Columbia Elec. Rly. Co., Ltd., Def. Ord. Stock	100	100 —103
		%	Pref. Ord. Stock	100	100 —103
133,301	10	6/-	Brit. Electric Traction, Ltd., Ord.	10	9¾ — 10¼
156,437	10	6/-	Do. 6% Cum. Pref.	10	11⅞ — 11½
£1,000,000	Stk	5%	Do. 5% Perp. Deb. Stk. ..	100	119 —121
£250,000	Stk	4½%	Do. 4% 2nd Deb. Stk. Red..	100	97 — 99
100,000	5	1/6	Buenos Ayres & Belgrano Electric Trams, Ltd., Ord.	5	¼ — 4½
40,500	5	3/-	Do. "A" 6% Cum Pref. ..	5	5⅞ — 6⅛
27,000	5	3/-	Do. "B" do.	5	5⅛ — 5⅜

ELECTRIC TRACTION.—*Contd.*

Present Amount Subscribed.	Shares	Last Dividend	Name	Paid up.	Closing Prices
£200,000	Stk	5%	Buenos Ayres Elec. Trams Co. (1901) Ltd., 5% Deb. Stk., Red.	100	94 97
£220,000	100	6%	Buenos Ayres Gd. Nat., Ltd., 6% 1st Deb. Bds.	100	99 - 102
102,268	5	3/-	Calcutta Tramways Co., Ltd. ..	5	8⅝ 8⅞
£350,000	Stk	4½%	Do. 4½% 1st Deb. Stk., Red.	100	106 —108
480,000	1	6d.	Cape Electric Tramways, Ltd. ..	1	1⅛ 1⅜
40,000	5	2/6	City of Birmingham Trams Co., Ltd. 5% Cum. Pref.	5	4⅞ 5⅛
£300,000	100	4%	Do. 4% 1st Mort. Debs. ..	100	101 104
£120,000	Stk	5%	Colombo Elec. Tram. & Light. Co., Ltd., 5% 1st Mort. Deb. Stk. Red.	100	101 —104
60,000	10	6/-	Dublin United Trams. Co. (1896), Ltd., Ord. ..	10	13 14
59,987	10	6/-	Do. 6% Pref...	10	15½ — 16
30,000	5	2/6	Isle of Thanet Elec. Trams. and Light. Co., Ltd., 5% Cum. Pref.	5	3½ — 4
£150,000	Stk	4%	Do. 4% Deb. Stock.. ..	100	90 — 93
125.000	10	5/-	London United Trams. (1901), Ltd., 5% Cum. Pref.	10	10¼ — 10⅜
£1.031,000	Stk	4%	Do. 4% 1st Mort. Deb. Stk. Red.	100	104 —106
£50,000	Stk	5%	Madras Electric Trams (1904), Ltd., 5% Deb Stock, Red.	100	101 —103
314,016	1	—	Metropolitan Elec. Trams, Ltd., Def.	1	⅛ ⅜
500,000	1	6d.	Do. 5% Cum. Pref... ..	1	¼ — 1⅛
£350,000	Stk	4½%	Do. 4½% Deb. Stock, Red.	100	103 —105
50,000	5	6/-	New General Traction Co., Ltd., 6% Cum. Pref.	5	½ - 1½
110,923	8	2/9	North Metropolitan Tramways Co..	8	4⅝ — 5¼
£150,000	100	3½%	Do. 3½% Mort. Debs.	100	90 — 95
£196,200	Stk	5%	Perth Electric Trams, Ltd. (W.A.) 5% 1st Mort. Deb. Stock, Red..	100	102 —105
24,500	10	10/-	Potteries Elec. Traction Co., Ld., Or.	10	8 — 9
24,500	10	5/-	Do. 5% Cum. Pref. ..	10	8½ — 9½
£220 000	Stk	4½%	Do. 4½% Deb. Stk., Red.	100	99 —102

IV.—ELECTRIC LIGHTING AND POWER.

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up.	Closing Prices.
7,500	10	16/-	Bournemouth & Poole Elec. Sup. Co., Ltd., Ord. ..	10	12 — 12½
7,500	10	4/6	Do. 4½% Cum. Pref. ..	10	9⅜ — 10
7,500	10	6/-	Do. 6% Cum. Second Pf. ..	10	11 — 12
£70,000	Stk	4½%	Do. 4½% Deb. Stock Red ..	100	103 —105
14,000	5	2/-	Bromley (Kent) Elec. Lt. & Pr. Co. Ld	5	5½ — 5¾
£50,000	Stk	4½%	Do. do. 4½% 1st Deb. Stk. Red.	100	101 —104
27,507	5	4/6	Brompton & Kensington Elec. Supply Co., Ltd. Ord. ..	5	10½ — 11
12,493	5	3/6	Do. 7% Cum. Pref. Shares..	5	10½ — 10⅝
60,000	5	3/-	Calcutta Elec. Sup. Cor. Ltd., Ord..	5	8⅜ — 8⅝
£288,782	Stk	4%	Central Elec. Sup. Co., Ltd., 4% Gua. Deb. Stk. ..	100	105 — 108
70,000	5	4/-	Charing Cross & Strand Elec. Sup. Corp., Ltd., Ord... ..	5	8¼ — 8⅝
80,000	5	2/3	Do. do. 4½% Cum. Pref...	5	5⅜ — 5½
£350,000	Stk	4%	Do. do. 4% Deb. Stk. Red.	100	101 —103
44,436	5	2/3	Chelsea Elec. Sply. Co., Ltd., Ord.	5	6⅜ — 7½
£150,000	Stk	4½%	Do. do. 4½% Deb. Stk., Red	100	108 —110
70,595	10	5/-	City of London El. Lghtg. Co., Ld., O.	10	11⅜ — 12¼
40,000	10	6/-	Do. 6% Cum. Pref.	10	13½ — 14
£400,000	Stk	5%	Do. 5% Deb. Stk., Red ..	100	121 —125
£300,000	Stk	4½%	Do. 4½% 2nd Deb. Stk., Red	100	101 —103
40,000	10	4/-	County of London Elec. Supply Co., Ltd., Ord.	10	9 — 9½
30,000	10	6/-	Do. 6% Cum. Pref.	10	12 — 12½
£400,000	Stk	4½%	Do. 4½% Deb. Stk., Red. ..	100	107 —110
70,000	5	2 6	Edmundson's Elec. Cor. Ltd., Ord.	5	6¾ — 6¾
70,000	5	3/-	Do. 6% Cum. Pref.	5	6 — 6¼
£300,000	Stk	4½%	Do. 4½% 1st Mort. Db. Stk. Reg	100	106 —108
£80,000	Stk	5%	Electric Lighting & Traction Co. of Australia, Ltd. 5% Deb. Stk. Red.	100	86 — 91
10,000	5	2/-	Folkestone Elec. Supply Co., Ld., O.	5	5½ — 6
£50,000	Stk.	4½%	Do. 4½% 1st Deb. Stk., Red.	100	101 —104
15,000	10	—	Havana Electricity Co., Ltd... ..	10	9½—10½
13,000	£	3/6	Hove Elec. Lighting Co., Ltd., Ord.	5	7½ — 8
£50,000	Stk	4½%	Isle of Wight Electric Light & Power Co., Ltd. 4½% Deb. Stock, Red.	100	100—102
150,000	1	—	Kalgoorlie Electric Power & Lighting Corp, Ltd., 6% Cum. Pref.	1	1⅛ — 1⅛
21,000	5	5/-	Kensington and Knightsbridge Electric Lighting Co., Ltd., Ord. ..	5	12¾ — 13½

Stocks and Shares marked * are quoted ex-dividend

ELECTRIC LIGHTING AND POWER.—*Contd.*

Present Amount Subscribed	Shares	Last Dividend	Name.	Paid up	Closing Prices.
£135,000	Stk	4 %	Kensington and Knightsbridge Electric Lighting Co., Ltd., and the Notting Hill Electric Lighting Co., Ltd., 4 % Deb. Stock, Red.	100	102 —104
111,000	3		London Elec. Supply Corp., Ld., Ord.	3	2⅜ — 2½
60,000	5	3/-	Do. 6 % Pref.	5	5⅛ — 5¼
£371,895	Stk	4 %	Do. 4 % 1st Mort. Db. Stk. Red.	100	96 — 98
100,000	10	2	Metropolitan Elec. Sup. Co., Ld., Or.	10	17½ — 18½
76,121	5	2/3	Do. 4½ % Cum. Pref.	5	5 — 5⅛
220,000	Stk	4½	Do. 4½ % 1st Mort. Db. Stk. Red	100	110 —115
250,000	Stk	3½	Do. 3½ % Mort. Deb. Stk., Red	100	96 — 98
£250,000	—	1½	Midland Elec. Corp. for Power Distribution Ld., 4½ % 1st Mort. Deb.	100	92 — 95
10,852	10	6/-	Notting Hill Elec. Ltg. Co. Ltd. Ord.	10	14½ — 15
£70,000	100	4⅗	Do. 4 % 1st Mort Debs.	100	102 —104
15,500	5	2/6	Oxford Electric Co. Ltd., Ord.	5	6½ — 6⅝
£50,000	Stk	4 %	Do. 4 % Debenture Stk. Red.	100	98 — 100
£84,700	100	4⅓⅗	Royal Elec. Co. (of Montreal) 4½ — 20 yr. 1st Mort. Deb	100	100 —102
40,000	5	5/-	St. James' & Pall Mall Elec. Light Co., Ltd. Ord.	5	13¾ 14½
20,000	5	4/6	Do. 7 % Pref...	5	8½ — 9
£150,000	Stk	3½	Do. 3½ % Deben. Stock, Red	100	98 —100
12,000	5	4/-	Smithfield Markets Elec. Supply Co., Ltd. Ord.	5	2¾ — 3¼
£50,000	Stk	4 %	Do. 4 % Debenture Stk. Red.	100	83 — 87
65,000	5	4/-	South London Elec. Sup. Co., Ltd. O.	5	4⅛ — 4⅜
100,000	1		South Metropolitan Elec. Light & Power Co., Ltd. Ord.	1	⅝ — 1
50,000	1	8d.	Do. 7 % Cum. Pref. ..	1	1⅛ 1⅜
£100,000	Stk	4½ %	Do. 4½ % 1st Deb. Stock Red.	100	107 — 110
50,000	5	2/6	Urban Electric Supply Co., Ltd., O.	5	5 — 5⅛
80,000	5	2/6	Do. 5 % Cum Pref. ..	5	5⅛ — 5⅜
£200,000	Stk		Do. 4½ % 1st Mort. Deb. Stk. Red	100	105 —107
110,000	5	6/6	Westminster Elec. Supply Corp. Ltd., Ord.	5	13 — 13⅜
28,151	5	2/6	Do. 5 % Cum. Pref.	5	6 — 6¼

V.—TELEGRAPH & TELEPHONE COMPANIES.

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up.	Closing Prices.
£34,800	100	4 %	African Direct Tel. Co., Ld., 4% Mt. Debs. (Series A), Red.	100	99 102
25,000	10		Amazon Telegraph Co., Ld.	10	1 1¼
£763,580	Stk	12/6	Anglo-American Tel. Co., Ltd., Ord.	100	56 58
£3,118,210	Stk	25	Do. 6 % Preferred Ordinary	100	102 — 104
£3,118,210	Stk	2	Do. Deferred Ordinary ..	100	11½ — 11¾
14,000	5	3/	Chili Telephone Co., Ltd.	5	6⅝ — 6¾
$15,000,000	$100	$2	Commercial Cable Co., Capital Stk.	$100	170 190
£1,903,826	Stk	4 %	Do. Sterl. 500-yr 4 % Deb. Stk., Red.	100	95 97
16,000	10	5/-	Cuba Submarine Tel. Co., Ld., Ord.	10	8¾ 9¼
6,000	10	10/-	Do. 10% Preference	10	16½ 17½
6,000	5	2	Direct Spanish Telegraph Co., Ord.	5	3⅜ 3⅝
		5/-	10 % Cum. Preference	5	7½ 8¼
£30,000	50	4½ %	Do. 4½ % Debs.	50	100 102
60,710	20	3	Direct U.S. Cable Co., Ltd... ..	20	10⅝ 10⅞
£85,800	100	4½	Direct West India Cable Co., Ltd., 4½% Reg. Debs.	100	99 —101
£300,000	100	4%	East. & S. African, Ld., 4 % Mt. Dbs.	100	101 —103
£200,000	25	4	Do. 4% Rg. Mt. Dbs. (Mauritius Subsidy)..	25	100-102 ..
300,000	10	2/6	Eastern Extension, Australasia and China, Ltd...	10	13⅜ 14
£602,400	Stk	4 %	Do. 4% Mort. Deb. Stk., Perp.	100	104 —106
£1,000,000	Stk	25	Eastern Tele. Co., Ltd., Ord.	100	134 137
£2,000,000	Stk	17/6	Do. 8 % Pref. ..	100	87 — 89
£1,836,814	Stk	4	Do. 4 % Mort. Deb. ..	100	105 107
150,000	10	5/	Great Northern Telegraph Co., Ltd., (of Copenhagen) ..	10	29½ 29⅝
£58,700	100	4½	Halifax and Bermudas Cable Co., Ltd., 4½ % 1st. Mort. Debs. Red.	100	99 —101
17,000	25	12/6	Indo-European Tele. Co., Ltd. ..	25	15 17
72,480	1	7½d.	Monte Video Telephone Co., Ltd., O.	1	⅞ 1
£1,983,443	Stk	6	National Telephone Co., Ltd., Pref.	100	103½ 104½
£1,966,667	Stk	5 %	Do. Deferred	100	108—110
250,000	5	2/6	Do. 5% Non-Cum. 3rd Pref.	5	5⅛ 5¼
£2,000,000	Stk	3½	Do. 3½% Deb. Stk., Red. ..	100	96 98
£989,593	Stk	4 %	Do. 4 % do. do.	100	101 —103
179,313	1	7½d.	Oriental Telephone & Elec. Co., Ltd.	1	1 1⅛
50,000	1	7½d.	Do. 6 % Cum. Pref.	1	1⅛ 1¼
£100,000	100	4	Pacific & European Tel. 4 % Guar. Debs. Red...	100	96 — 99
11,839	8	4/-	Reuter's Telegram Co., Ltd. ..	8	7 — 7¼
58,000	5	3/-	United River Plate Telep. Co., Ltd.	5	6⅝ 7¼
40,000	5	2/6	Do. 5 % Cum. Pref. ..	5	5 5¼
£179,947	Stk	5 %	Do. 5% Deb. Stock, Red. ..	100	105 107
15,000	10	4/-	W. African Telegraph Co., Ltd. ..	10	7¼ 7½
£30,008	24		West Coast of America, Ltd. ..	24	¼ ⅜
150,000	100	4	Do. 4 % Deb. Guar. by West. Tel	100	99 101

TELEGRAPHS AND TELEPHONES.—*Contd.*

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices.
88,321	10	6d.	W. India & Panama Teleg. Co., Ld., Or.	10	6— 7
31,353	10	6/-	Do. 6 % Cum. 1st Pref.	10	7⅜ 7¾
1,669	10	6/-	Do. 6 % Cum. 2nd Pref. ..	10	6⅞— 7¼
£80,000	100	5 %	Do. 5 % Deb. ..	100	101 —103
247,940	10	1	Western Telegraph Co., Ltd.	10	13½— 14
£75,000	100	5	Do. 5 % Deb., 2nd Series, Red.	100	101 103
518,945	Stk	4 %	Do. 4% Deb. Stock, Red	100	100 102½

VI.—SHIPPING COMPANIES.

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices.
32,500	10	5/6	Anchor Line (Henderson Bros.), Ltd., 5½ % Cum. Pref	10	8½ 9
£375,000	Stk	4 %	Do. 4½ % Red. 1st Mort. Deb. Stk.	100	99 101
£672,900	Stk	4 %	British & African Stm. Nav. (1900) Ltd., 4½% 1st Mort. Deb. Stk., Red.	100	93 95
40,000	10	5/6	Bucknall Steamship Lines, Ltd., 5½ % Cum. Pref.	10	6 6½
£60,000	Stk	4 %	Do. 4½% 1st Mort. Deb. Stk.	100	73 — 76
£75,000	Stk	4 %	Clan Line Steamers, Ltd., 4½ % Deb. Stk. Red. ..	100	98 —100
60,000	20	16/-	Cunard Steam Ship Co., Ltd., Nos. 1-60,000	20	13½ 14
40,000	20	8	Do. Nos. 60,001 100,000	10	6 — 6½
£464,430	Stk	4 %	Elder Dempster Shipping, Ltd., 4½ % 1st Mort. Deb. Stk. ..	100	101 —103
1,200,000	1	6d.	Furness, Withy & Co., Ltd., Ord...	1	1⅛ 1¼
25,328	7½	4/7	Gen. Steam Navigation Co., Ld., Ord.	7½	4½ 4¾
36,758	8	4/9	Do. Non-Cum. 6 % Pref.	8	7½ 7¾
£150,000	Stk	4	Do. 4 % 1st Mort. Deb. Stk. Red.	100	97 — 99
55,000	5	1/3	Houlder Line, Ltd., Ord. ..	5	3 — 3½
40,000	5	2/9	Do. 5½ % Cum. Pref.	5	3½ 3⅞
£200,000	Stk	4½ %	Do. 4½% 1st Mt. Deb. Stk. Red.	100	83 — 86
141,500	10	5/-	Leyland (Fredk.), & Co.. (1900), Ltd., 5 % Cum. Pref. ..	10	4⅝ - 5
£1,160,000	Stk	5 %	Peninsular and Oriental Steam Nav. Co., 5 % Cum. Pref	100	126 —129
£1,160,000	Stk	19%	Do. do Deferred .	100	218 —221
15,000	100	30/-	Royal Mail Steam Packet Co. Ord..	60	26 — 27
39,075	5	2/6	Shaw, Savill & Albion, Ltd., 5 % Cum. "A" Pref..	5	4¼ — 5¼
39,075	5	2/6	Do "B" Ord...	5	4 4½
141,841	10	4/	Union Castle Mail Steamship Co., Ltd., Ord..	10	8 — 8½
24,000	10	4/6	Do. 4½ % Cum. Pref.	10	9¾ 10¼
£1,008,894	Stk	4 %	Do. 4 % Debenture Stk., Red.	100	99 —101

VII.—MISCELLANEOUS COMPANIES.

Present Amount Subscribed	Shares	Last Dividend	Name	Paid up	Closing Prices.
60,000	1	9d.	Chadburn's (Ship) Tele. Ltd., Ord. .	1	⅝ 1⅛
£750,000	Stk	5 %	General Hydraulic Power Co., Ltd.	100	138 143
12,500	10	10/-	Oakey (John) and Sons, Ltd.. Ord	10	21 26
10,000	10	6/-	Do do. 6 % Cum. Pf	10	14 — 15
183,548	1	6¾d.	Power Gas Corp., Ltd., Ord., Nos. 66,463 250	15/-	⅝ ⅞
66,462	1	8¼d.	Do. do. Nos. 1 66,462	1	⅞ 1⅛
135,000	1	6d.	Waygood (R.) & Co., Ltd., Ord. ..	1	1⅛ 1⅜
135,000	1	7½d.	Do. 6 % Cum. Pref.	1	1¼ 1¼

RAILWAY CARRIAGE & WAGON COMPANIES.

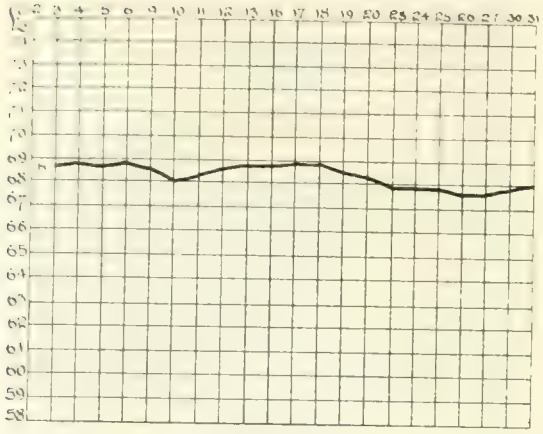
Present Amount Subscribed	Shares	Last Dividend	Name	Paid up.	Closing Prices
10,000	10	7/6	Birm. Railway-Car, & Wagon, L., 1-10,000	10	21½ 21¾
8,739	10	3/	Do. Second Issue 1-8,739 ...	1	8½ 8⅝
10,000	10	6/-	Do. Cum. Pref. 6 % 1-10,000	10	13 — 13½
30,111	7	7/-	Gloucester Rail.-Car & Wagon, Ld., A, 1-29,861 & 49,751-50,000	7	9 — 9⅜
44,889	7	3/6	Do. B, 29,862-49,750, 50,001-75,000	7	4 - 4½
14,567	10	4/3	Lancashire Wagon, Ord.	2	2⅛ 2⅜
4,150	10	5/-	Do. do.	10	10½ 10¾
784,808	1	9d.	Metropolitan Amalgamated Rail.-Carriage & Wagon, Ld., 1-784,808	1	39/9 40/3
164,288	1	6d.	Do. Cum. A Pref. 5 % 1-164,288	1	23/6 24/6
235,000	1	7½d.	Do. Cum. B Pref. 6 % 1-235,000	1	28/3 — 28/9
20,000	20	20/-	Midland Rail. Car. & Wagon, L.L., 1-20,000	10	19 — 20

Stocks and Shares marked * are quoted ex-dividend.

THE HOME METAL MARKET.

SHOWING DAILY FLUCTUATIONS FROM JANUARY 2ND, 1905, TO JANUARY 31ST, 1905.

COPPER.



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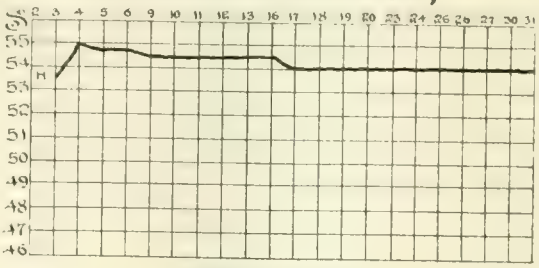

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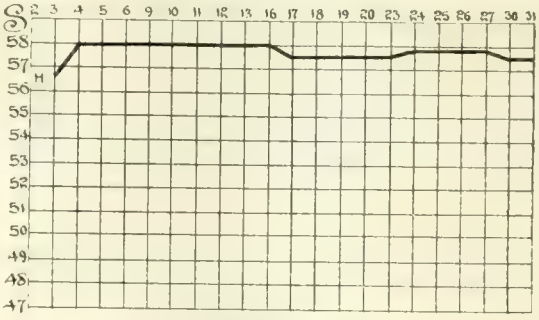

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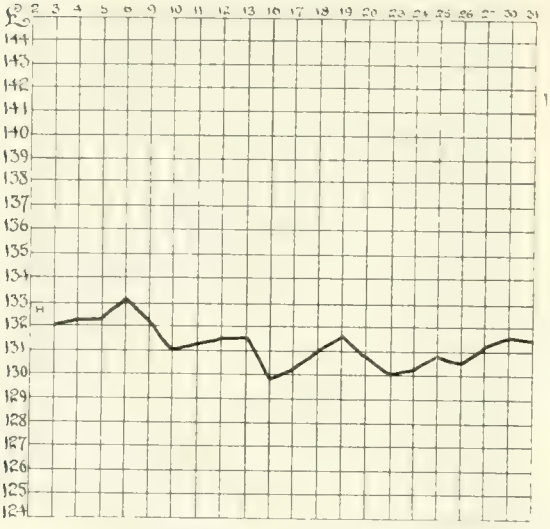

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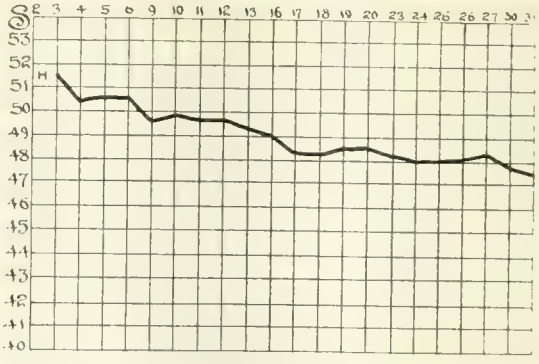
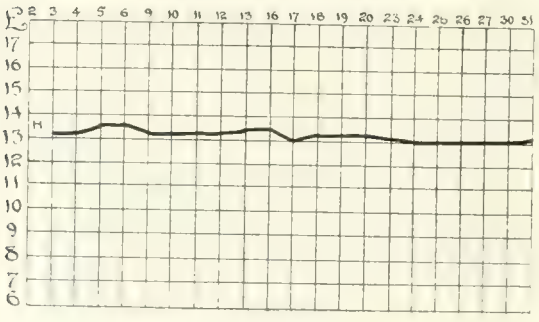
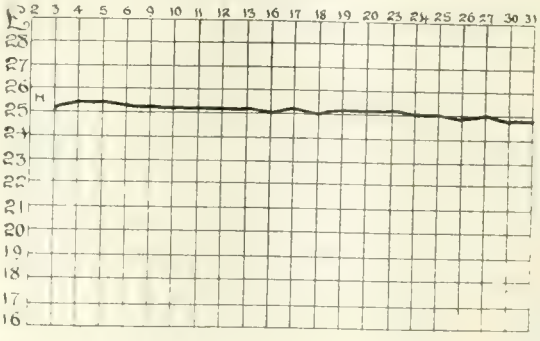


ENGLISH LEAD.



SPELTER.



PRICES CURRENT OF COAL, IRON, STEEL, AND OTHER METALS.

MANUFACTURERS' AND MERCHANTS' QUOTATIONS.

MARKET REPORT.

Wednesday, February 1st, 1905.

VALUES in the copper market have moved within comparatively narrow limits. At one time a rise of £5 seemed imminent, but the large offerings of metal were readily absorbed, and American trade advices still being favourably interpreted, the latest tendency is towards recovery, the improved tone being assisted by covering operations on the part of the bears. The visible position is an interesting one. Messrs. Robert Katz and Co.'s circular points out that the greater consumption in America will be offset to some extent by the steady increase in production, but the balance of opinion is in favour of higher prices for copper.

Tin has been more active, quotations showing an upward trend in spite of the amount of metal sold in anticipation of the Banca sale. Good prices were realised at the sale, the parity of £132 per ton being secured for 3,400 slabs. The large quantity sold, as Messrs. Merton and Co. point out, had a temporary retarding effect on quotations, but good buying ensued, and with Eastern holders unwilling to sell, the market [illegible].

While the explanation of the slight check in the tin trade revival is disappointing. Probably, however, the [illegible] only temporary, and certainly the weakness [illegible] had the effect of bringing in buyers and imparting a firmer tone to quotations. The German [illegible] had little or no effect on the home steel trade, the reports from the leading industrial centres are fairly encouraging, and with more activity in the shipbuilding yards promised, the outlook must be considered [illegible].

Large arrivals of unsold metal from abroad depressed [illegible] at the end of last week, but the demand [illegible] improved, and quotations at the time of writing show [illegible]. Soft foreign [illegible] and English £13.

Spelter has suffered from the realisation of speculative [illegible]. In their annual circular Messrs. Rudolph, Wolff, Kreuger and Co. point out that the consumption in Germany and Great Britain last year, and [illegible] war material by both Russia and Japan.

IRON, STEEL, PIG-IRON, &c.

SCOTLAND.

Messrs. David Colville and Sons, Ltd., Dalzell Steel and Iron Works, Motherwell, N.B., quote as follows. Prices delivered in Glasgow or equal:—

	£	s.	d.
Steel:			
Siemens' Steel Plates, Marine Boiler Quality	6	15	0
,, ,, ,, Land ,, ,,	6	17	6
,, ,, ,, Ship Quality Plates	5	17	6
Siemens' Steel Bars, Boiler Quality	6	17	6
,, ,, ,, Ship ,,	6	7	6
,, ,, Angles	5	7	6
Manufactured Iron:			
Bars—Dalzell	6	2	6
,, Best	6	12	6
,, ,, Horseshoe	6	12	6
,, Angle	6	2	6
,, Best Angle	6	12	6
,, Best Best	7	2	6
,, Extra Best	7	12	6

Usual terms and extras. Special rates for delivery in England and export. The above prices subject to alteration without notice.

The Glasgow Iron and Steel Co., Ltd., Wishaw, quote as under (prices are delivered Glasgow or equal):

	£	s.	d.	
Steel Angles (Glasgow [illegible] Steel)	5	[illegible]	0	per ton
Steel Ship Plates (Glasgow [illegible] Steel)	5	18	0	,,
Steel Bars, Ship Quality (Glasgow [illegible] Steel)	6	8	0	,,
Steel Bars, Boiler Quality (Glasgow [illegible] Steel)	6	18	0	,,
Steel Land Boiler Plates (Glasgow [illegible] Steel)	6	7	6	,,
Steel Marine Boiler Plates (Glasgow [illegible] Steel)	6	7	6	,,

Less 5 per cent. discount. Extras on standard list.

Special prices for delivery in England and for export. The above prices subject to alteration without notice.

John Spencer (Coatbridge), Ltd., Phœnix Iron-works, Coatbridge, N.B., [illegible]

	£	s.	d.
Bars—Phœnix	6	5	0
,, Best	6	15	0
,, Best Best	7	5	0
,, Extra Best	7	15	0
,, Best Horse Shoe	6	15	0
,, Extra B.H.S.	7	15	0
,, Extra Best Angle	8	5	0
,, Iron	6	5	0
,, Best Ship Iron	7	5	0

	£ s. d.
Angles—Phœnix	6 5 0
,, Best	6 15 0
,, Extra Best	7 5 0
Gas Tube Hoops—Phœnix Best	6 15 0
Plates—Phœnix	
Best Boiler	7 10 0
Best Best Boiler	8 0 0
Extra Best Boiler	9 0 0
Boiler Tube Strips—Phœnix Best Best	8 0 0

All per ton, delivered f.a.s. Glasgow, Greenock, Grangemouth, Granton, Leith, or Ardrossan 5 per cent discount cash monthly.

Messrs. R. Feldtmann and Co., of Glasgow, quote Commission extra).

Pig Iron:	No. 1. £ s. d	No. 3. £ s. d
Coltness, f.a.s. Glasgow	3 5 0	2 15 0
Gartsherrie ,,	2 19 6	2 14 6
Summerlee ,,	3 0 6	2 15 0
Carnbroe ,, ,,	2 17 6	2 14 0
Langloan ,, ,,	3 4 0	2 16 0
Calder ,,	2 19 0	2 14 6
Clyde ,,	2 19 0	2 14 6
Glengarnock, f.o.b. Ardrossan	2 19 0	2 13 6
Eglinton ,, ,,	2 15 6	2 13 0
Dalmellington, ,, Ayr	2 15 6	2 13 0
Shotts ,, Leith	2 19 0	2 14 6

NORTH OF ENGLAND.

Messrs. W. Whitwell and Co., Ltd., Thornaby Ironworks, Stockton, quote as follows, **at works:—**

	£ s. d.
W.W. Bars	6 12 6
W.W. Best Bars	7 2 6
W.W. Best Best	7 12 6
W.W. Best Best Best	8 2 6
W.W. Best Shoe	7 2 6
Thornaby	8 2 6
Thornaby Best	8 12 6
Thornaby Best Best	9 12 6
Whitwell Special Admiralty Cable	10 5 0
Special Chain Iron	9 5 0
Tube and Nail Strips	6 15 0
W.W. Angle Iron	6 15 0
W.W. Best Angle Iron	7 5 0
Tee Iron, to 8-inches United	7 12 6

Terms, Cash, less 2½ per cent. discount on 10th of month following delivery

LANCASHIRE.

The Pearson and Knowles Coal and Iron Company, Ltd. Dallam and Bewsey Forges, Warrington, quote:—

	Iron. £ s. d.	Steel. £ s. d.
Crown (BNF) Bars	6 10 0	7 5 0
,, ,, Angles	7 0 0	7 5 0
,, ,, Tees	7 10 0	7 15 0
,, (WIW) Hoops	7 0 0	7 10 0
,, ,, Sheets	7 10 0	8 0 0

Ordinary Sizes, F.A.S. Liverpool in 10-ton Lots.
Extras for Sizes and Cutting as per List.

WORCESTERSHIRE.

Baldwins Ltd. (with which is amalgamated Knight and Crowther, Ltd.), Wilden Works, near Stourport, quote:—

Black Sheets:	Singles 20 G 96in. by 36in. per ton. £ s. d.	Doubles 21 G to 24 G 96in. by 36in. per ton. £ s. d.
"Vale"	10 0 0	10 10 0
"Shield"	10 10 0	11 10 0
"Severn"	11 10 0	12 10 0
"Baldwin Wilden B"	12 10 0	13 10 0
Charcoal	16 10 0	17 10 0
Best Charcoal	18 10 0	19 10 0

Pickled, cold-rolled and close annealed sheets specially quoted for.

Extra widths, Singles to 66in., Doubles to 56in., Lattens to 46in. Extra lengths, Singles to 168in., Doubles to 132in., Lattens to 108in.

Patent Coated Sheets:

	£ s. d.	£ s. d.
No. 3 Lead	13 10 0	14 10 0
S.V. Lead	15 0 0	16 0 0
No. 3 Terne	15 0 0	16 0 0
S.V. Terne	16 10 0	17 10 0

Tinned Sheets:	Singles 20 G to 108 by 36in. per ton. £ s. d.	Doubles 21 to 24 G to 96 by 36in per ton. £ s. d.
Best Coke (Finish)	28 0 0	29 10 0
,, Charcoal (Finish)	30 0 0	31 10 0
Extra ,, ,,	32 0 0	33 10 0

Cotton Can Tin Sheets to 39in. by 36in. specially quoted for.
Tin Plates, "Cookley, K" Best Charcoal, £1 7s. 0d. per box.
Extreme sizes in Tin and Patent Coated specially quoted for.
Lattens up to 36 wide by 27 W.G. £1 10s. 0d. per ton extra throughout for all brands.
At works less 2½% for cash monthly, 10th inst

Galvanized Corrugated Sheets:

	£ s. d.	
"Phœnix" Brand, 24 G., f.o.b. London, in Bundles	11 15 0	per ton.
"Blackwall" Brand, 26 G., in felt lined cases for Australia, f.o.b. London	14 7 6	,,

Galvanized Working Up-Sheets:

	£ s. d.	
24 G., f.o.b. London, in Bundles	13 15 0	per ton.

STAFFORDSHIRE.

Shelton Iron, Steel, and Coal Co., Ltd., Stoke-on-Trent, North Staffordshire, and 122, Cannon Street, London, quote:—

	£ s. d.	
Crown Bars	6 10 0	per ton.
Best Bars (1 to 6in. wide, above ¼ in. thick, ½ in. to 4 rounds and squares)	7 0 0	,,
Angles	6 15 0	,,
,, Best	7 5 0	,,
T's	7 0 0	,,
,, Best	7 10 0	,,
Best Shoe Iron	8 0 0	,,
,, Rivet Iron	8 0 0	,,
,, Best Rivet (Special)	9 5 0	,,
,, Cable	9 5 0	,,
,, Screwing	8 5 0	,,

	£	s.	d.	
Best Bars	8	0	0	per ton
Best Bars	8	5	0	..
Best Best	9	5	0	..
,, Treble	10	5	0	,,
Plates	7	10	0	..
Best Plates	8	0	0	..
Best Plates	8	10	0	..
Best Boiler Plates	9	10	0	..
Best Best Boiler Plates	12	0	0	..

WALES.

Cordes (Dos Works), Ltd., of Newport, Mon., quote "Star" brand patent wrought nails, free nail Ac

Discounts –

45 per cent off 1 inch to 3 inch 6 strong rose and all fine rose and fine head cut pointed.

40 per cent off 3½ inch to 7 inch strong rose and 10dy and 20dy pointed.

40 per cent off all sharp pointed nails.

Delivered in lots of 4 cwt and upwards. Extra 2½ per cent discount off the prices on two tons and upwards.

Steel cut clout points, 5 inch to 7 inch inclusive —

2 tons 6s 6d per cwt. delivered any Railway Station

1 cwt to 2 cwt and upwards 6s 9d per cwt.

Steel cut nails, 3-inch basis

2 tons 6s 3d per cwt

1 cwt to 2 tons 6s 6d per cwt. delivered any Railway Station

Steel rods from £7 10s per ton, at works for 2 ton lots.

Messrs. Richard Thomas and Co., Ltd., of 33 and 35, Eastcheap, E. C. — Works: South Wales, Burry, Lydney, Lydbrook, and Cwmbwrla, quote

	Per Box. f.o.b. Wales. £	s.	d.
Coke Tin-plates.			
C 18 by 14 124s. 110 lb "BV"	0	13	0
C 20 by 10 225s. 155 .. "Jones"	0	18	3
C 20 by 14 112s. 108 .. "Lydbrook"	0	12	6
C 28 by 20 112 216 .. "Lydbrook"	1	5	3
Charcoal Tinplates:			
C 20 by 14 112 108 lb "Allaway"	0	13	3

BELGIUM.

C. L. Faulkner, Suffolk House, Laurence Pountney Hill, London, E.C., quote

Prices quoted are in £ stg. and per ton of 1,015 kos. (2,240 lb.) delivered free on board ANTWERP for approved quantities.

	£	s.	d.	
Steel:				
Blooms	at 3	12	0	per ton.
Billets	at 3	14	0	..
Sheet Bars	at 3	16	0	..
Finished Steel:				
Bars	at 4	19	0	per ton.
Angles	at 5	0	0	..
Tees	at 5	5	0	..
Joists	at 4	10	0	..
Fencing Standards	at 5	2	0	..
Shoeing Bars	at 5	4	0	..
Tyre Bars	at 5	4	0	..
Half Rounds Bars	at 5	5	0	..
Heavy Rails	at 4	15	0	..
Light Rails	at 4	17	6	..
Structural Steelwork:				
Prices on application				

METALS.

Messrs. French and Smith, 147, Leadenhall Street, and 11, Oldhall Street, Liverpool, quote :–

TIN.

Tin:	£	s.	d		£	s.	d	
English Ingots, f.o.b. ...								
Dis. 1¼ & 1 ...	132	0	0	to	132	10	0	per ton
English Bars, f.o.b. ...								
Dis. 1¼ & 1 ...	133	0	0	to	133	10	0	
Straits G.M.B., cash Warehouse, Net	132	0	0	to	132	10	0	
Straits G.M.B., 3 months, Warehouse, Net	130	15	0	to	131	0	0	
Australian, Mr Basis, Warehouse, Net	132	10	0	to	133	0	0	

COPPER.

Copper:	£	s.	d.		£	s.	d	
Standard G.M.B., cash Warehouse, Net ...	67	17	6	to	68	0	0	per ton.
Standard G.M.B., 3 months, Warehouse, Net ...	68	0	0	to	68	2	6	
English, Tough, Cake & Ingot, Warehouses, Net	70	10	0	to	71	0	0	
English, Best Select, Warehouse Net	71	0	0	to	71	10	0	
English, Sheets and Sheathing, f.o.b., Dis. 2½	80	0	0	to	80	10	0	
English Sheets for India, f.o.b., Dis. 2½ ...	76	0	0	to	76	10	0	
Electro, Warehouse, Net .	70	15	0	to	71	0	0	
Ore, ex ship	0	12	0	to	0	13	0	per unit
Regulus, Matte and Precipitate, ex. ship,	0	13	3	to	0	14	0	

YELLOW METAL.

Yellow Metal:	£	s.	d	£	s.	d.	
Sheets, 4 by 4 feet for India f.o.b. Dis. 2½				0	0	6¾	per lb
Sheathing				0	0	6¾	

SPELTER

	£	s.	d.		£	s.	d.	
Silesian outports, Net	24	15	0	to	25	0	0	per ton
Blende of 50 %, Net	7	0	0	to	7	1	0	
Calamine, Net	7	2	6	to	7	12	6	

LEAD.

	£	s.	d.		£	s.	d	
English Pig, Warehouse, Dis. 2½ %	12	17	6	to	13	0	0	per ton.
Spanish, ex ship, Dis. 2½	12	15	0	to	12	17	6	
Lead Ore of 70 %, Net	6	12	6	to	6	15	0	

ANTIMONY.

	£	s.	d.		£	s.	d.	
Star Regulus, f.o.b., Dis. 2½ %	36	0	0	to	37	0	0	per ton.
Ore, 50 % ex ship, Dis. 2½	9	0	0	to	9	0	0	
Crude ex ship, Dis. 2½	13	10	0	to	14	0	0	

QUICKSILVER.

	£	s.	d	
Spanish, 75 lb. Warehouse Net	7	15	0	per lb.
Italian	7	14	0	

COAL.

LEICESTERSHIRE.

The Nailstone Colliery Company, Leicester, quote. Price per Ton at Pit of 20 Cwt., with ½ Cwt. per Ton for wastage.

Upper Main Seam.	s.	d.
Main Coal	7	6
Best Hard Steam (hand picked, as used by the Railway Companies)	6	0
Best Hard Steam Cobbles (made through 6 in. mesh, free from slack)	6	0
Fine Slack	0	6

Terms, net cash on 10th of month following delivery.

DERBYSHIRE.

The Manners Colliery Co., Ltd., of Ilkeston quote as follows, per ton at pit:

Kilburn Coal:	s.	d.
Best London Brights	9	9
Large Nuts (1½ to 3½)	9	6
Small Nuts (¾ to 1½)	6	0
Rough Brights	6	0
Peas (½ to ¾)	5	0
Slack	3	6
Smudge	2	0

Low Main (or Tupton) Coal:		
Low Main Brights	7	6
,, ,, Nuts	7	3
Hards (Good Steam Coal)	8	0
Bakers' Nuts (1" to 2")	6	6
Slack	3	6

The Clay Cross Company's Collieries, Clay Cross, near Chesterfield, quote:—

	per ton at pit. s.	d.
Best Main Coal	10	6
Best Silkstone	10	0
Best House Coal	8	6
Best House Nuts	8	0
Treble Screened Cobbles	7	9
Best Cobbles	7	3

NOTTINGHAMSHIRE.

The Digby Colliery Co., Ltd., near Nottingham, quote per ton at pit:—

Digby Coal:		
STEAM.	s.	d.
Best Hand Picked Hard	9	0
Steam Hard	7	9
Hard Nuts	7	0

Gedling Colliery.		
HIGH HAZEL.		
London Brights, 4 to 8 in. cube	12	0
Large Nuts, 2 to 4 in. cube	9	6
Small Nuts, ¾ to 2 in. cube	5	6
STEAM TOP HARD.		
Best Hard	9	0
Hard Steam	8	0
Cobbles	7	0

CHEMICALS AND OILS.

CHEMICALS.

Messrs. S. W. Royse and Co., Albert Square, Manchester, quote:

	£	s.	d.	
Acids: Oxalic	0	0	2½	per lb
Picric, Crystals	0	0	11	,,
Tartaric at Manchester	0	0	10⅞	,,

	£	s.	d.	
Acetate of Lime: Brown at Manchester net	9	10	0	per ton.
Grey ,,	11	10	0	,,
Alumina: Alum, Lump, loose	5	5	0	,,
,, ,, in casks	5	7	6	,,
,, Ground, in bags	5	15	0	,,
Sulphate of Alumina, 17°	4	10	0	,,
Ammonia: Carbonate	0	0	3½	per lb.
Muriate Grey f.o.b. Liverpool	24	0	0	per ton.
Sal-ammoniac, Lump, 1sts, del U.K.	12	0	0	,,
,, ,, 2nds, ,,	40	0	0	,,
Sulphate f.o.b. Liverpool	13	2	6	,,
Arsenic: Best White Powdered net	12	5	0	,,
Bleaching Powder, 35% ,,	4	10	0	,,
Borax: British Refined Crystal ,,	12	0	0	,,

Coal Tar Products:				
Benzole, 50 90%	0	0	8¼	per gal.
,, 90% ,,	0	0	10	,,
Carbolic Acid Crystals, 34 35 C	0	0	6⅝	per lb.
,, ,, ,, 39 40 C.	0	0	7⅛	,,
,, ,, Liquid, 97 99% ,,	0	0	9	per gal.
,, ,, Crude, 62½% at 60° F. f.o.b. ,,	0	2	0	,,
Creosote, ordinary good liquid ,,	0	0	1¼	,,
Naphtha, Crude, 20% at 120° C. ,,	0	0	3	,,
,, Solvent, 90% at 160° C. f.o.b. ,,	0	0	8½	,,
,, ,, 95% at 160° C. ,,	0	0	9½	,,
,, ,, 90% at 190° C. ,, ,,	0	0	10½	,,
,, Rectified, flash point over 73° F. f.o.b.	0	0	11	,,
,, Rectified, flash point over 100° F. f.o.b. ,,		1	0	,,
Naphthalene, all qualities.				
Pitch f.a.s. Manchester. ,,	1	12	0	per ton.
Copperas: Green, in bulk ,,	0	12	6	,,
,, barrels f.o.b. L'pool ,,	1	19	0	,,
Cake	1	2	6	,,
Copper: Sulphate	22	5	0	,,

Cyanides: 98% minimum f.o.b. net	0	0	8	per lb.

Lead: Acetate (Sugar) White, English	27	10	0	per ton.
,, ,, ,, Foreign c.i.f. U.K.	24	5	0	,,
,, ,, Grey	21	15	0	,,
,, ,, Brown at Manchester	17	0	0	,,
Nitrate	24	0	0	,,
Litharge, Flake	15	10	0	,,
,, Powder	16	0	0	,,
Red Lead, Genuine, c.i.f. London less 5%	15	10	0	,,
White ,, ,, Dry ,, ,,	16	15	0	,,

Naphtha (Wood): Miscible, 60 o.p.	0	2	10	per gal.
Solvent	0	2	7	,,

Potash: Bichromate... delivered England	0	0	3	per lb.
Carbonate, 90/92% ... c.i.f Hull	18	0	0	per ton.
Caustic, 75/80°	20	10	0	,,
Chlorate net	0	0	3 1/16	per lb.
Montreal in Store, Liverpool	35	0	0	per ton.
Prussiate, Yellow net	0	0	4 15/16	per lb

		£	s.	d.	
Soda:	Ash, Caustic, 48 .. Ordinary ..	5	5	0	per ton.
	.. .. .. Refined .. .. ,,	6	5	0	..
	.. Carbonated, 48	5	10	0	
	.. 58 .. (Ammonia				
	Alkali) net	4	10	0	..
	.. Bleachers' Refined Caustic				
	50/52 net	6	10	0	..
	Caustic, White, 77	10	10	0	..
	,, 70 ,, .. ,,	9	12	6	..
	.. ,, 60 % .. .. ,,	8	12	6	..
	.. Cream, 60 ..	8	10	0	..
	Crystals, in bags	5	0	0	..
	.. barrels	3	7	6	..
	Acetate .. c.i.f. Hull net	16	10	0	..
	Bicarbonate, in 1 cwt. kegs	6	15	0	..
	Bichromate delivered England	0	0	2¼	per lb.
	Chlorate .. .. .. net	0	0	3 1/16	per lb.
	Nitrate, ex quay Liverpool, ...	11	7	6	per ton.
	Phosphate	9	5	0	..
	Prussiate .. .. net	0	0	3⅝	per lb.
	Silicate, Solution, 140 Tw.	4	10	0	per ton.
	Sulphate (Glauber Salts)	1	12	6	..
	,, (Saltcake, 95	1	15	0	..
Sulphur:	Recovered	4	15	0	..
	Roll	6	15	0	..
	Flowers ..	7	10	0	..
Zinc:	Sulphate	6	15	0	..

MINERALS.

		£	s.	d.	
Barytes:	Lump Carbonate, 90/92	3	10	0	per ton.
	Sulphate, No. 1, White ..	2	15	0	,,
China Clay:	of various qualities for all purposes; prices from about 11/- to about 30/- per ton, f.o.b. Cornwall: stocks also kept at Runcorn and Preston. Quotations given carriage paid.				
Chrome Ore:	Basis 50% c.i.f. British Ports	3	7	6	..
Manganese:	Lump c.i.f. Liverpool 10½d.				per metallic unit.
Ochre:	French JC .. f.o.b. Rouen, net	2	5	0	per ton.
	.. JF	5	10	0	..
Talc:	(French Chalk) c.i.f. Liverpool	3	10	0	..

OILS, etc.

		£	s.	d.	
Aniline Oil	.. net	0	0	4¾	per lb.
,, **Salt**	.. .. .. ,,	0	0	4½	..
Castor Oil:	French, 1st pressure, f.o.b. Marseilles less 1½ ..	23	0	0	per ton.
	English, 1st pressure, f.o.r. Hull, less 2½ %	24	0	0	..
Cocoa Nut Oil:	Ceylon, ex store Manchester .. .. net	29	10	0	..
	Cochin, ex store Manchester .. .. net	32	0	0	,,
Cotton Seed Oil:	Refined at Hull, less 2½% naked ..	12	15	0	..
	Edible...at Hull, less 2½ % naked ..	13	5	0	..
Glycerine:	Crude, 80 .. net	31	0	0	..
Linseed Oil:	Raw... ..at Hull, less 2½% naked	12	7	6	..
	Boiled ..at Hull less 2½ % naked	13	7	6	..
Starch:	American Pearl.. at Manchester, net	9	0	0	..
	Dextrine	18	0	0	..
	Farina	15	15	0	..
Shellac:	Standard TN orange spot ..	155			per cwt.
	March delivery ..	140			..
Turpentine	American .. at Liverpool ..	38	10	0	per cwt.
	Russian .. at Hull .. net	18	10	0	..

TIMBER.

Messrs. Alfred Dobell and Co., Liverpool, quote:

COLONIAL WOODS.

Timber.

		£	s.	d.		£	s.	d.
Quebec Square White Pine...	per cub. ft.	0	1	9	to 0	3	0	
Quebec Waney Board Pine...	..	0	2	8	0	3	9	
St. John Pine, 18 in. average	..	0	2	3	0	3	3	
Lower Ports Pine	..	0	1	3	0	1	8	
Quebec Red Pine ..	..	0	1	6	0	2	0	
Quebec Oak, 1st quality ..	..	0	2	9	0	3	3	
Quebec Oak, 2nd quality ...	..	0	1	6	0	2	6	
Ash ..	..	0	1	6	0	2	3	
Elm	..	0	3	0	0	3	9	
Hickory ..	..	0	2	0	0	2	6	
Quebec Birch	..	0	1	6	0	2	3	
St. John Birch	..	0	1	6	0	2	0	
Birch Planks ..	..	0	0	9	0	0	11	
Spruce Spars	..	0	0	10	0	1	0	

Deals.

		£	s.	d.		£	s.	d.
1st quality Quebec Pine ..	per std.	22	10	0	to 32	10	0	
2nd do. do. ..	..	17	0	0	22	0	0	
3rd do. do ..	..	11	10	0	13	0	0	
St. John, N.B., etc., Spruce	..	6	10	0	6	15	0	
Lower Ports Spruce	..	6	0	0	6	10	0	
Spruce Boards	..	5	10	0	6	0	0	

UNITED STATES, etc., WOODS.

Pitch Pine.

		£	s	d		£	s.	d.
Hewn	per cub. ft.	0	1	3	to 0	1	8	
Sawn	..	0	0	10	0	1	6	
Planks, Stowage	..	0	0	10	0	1	0	
Boards, Prime ..	per std.	12	10	0	16	0	0	
Oak Timber	per cub. ft.	0	1	6	0	2	6	
Oak Planks	..	0	1	6	0	2	1	
East India Teak ..	per load	12	0	0	15	0	0	
Greenheart	..	6	15	0	7	10	0	

EUROPEAN WOODS.

Timber.

		£	s.	d.		£	s.	d.
Riga Redwood	per cub. ft.	0	1	9	to 0	2	3	
Dantzic and Memel Fir, Crown	..	0	2	1	0	2	6	
Dantzic and Memel Fir, Middling	..	0	1	9	0	1	11	
Stettin	..	0	1	9	0	1	11	
Swedish	..	0	1	2	0	1	4	
Riga Whitewood	..	0	1	3	0	1	6	
Norway Mining Timber ..	..	0	0	9	0	0	10	
Dantzic and Stettin, etc., Oak	..	0	2	6	0	3	0	
Norway Spars	..	0	1	2	0	1	9	

Deals.

		£	s.	d.		£	s.	d.
Red Archangel and Onega, 1st quality ..	per std.	19	0	0	21	0	0	
Red Archangel and Onega, 2nd quality	,,	16	0	0	17	0	0	
Red Archangel and Onega, 3rd quality ..	..	12	10	0	15	0	0	
St. Petersburg, 1st quality...	..	16	0	0	17	10	0	
Do. 2nd ..	..	14	0	0	15	0	0	
Gefle	..	14	0	0	17	10	0	
Wyburg	..	12	0	0	13	10	0	
Uleaborg	..	12	0	0	13	10	0	
Gothenburg	..	14	0	0	17	10	0	

SELECTED PATENTS.

Compiled expressly for this Journal by **Messrs. Page and Rowlingson, Engineering Patent Agents, 28, New Bridge Street, London, E.C.,** and at Manchester.

Copies of Specifications may be obtained at the Patent Office Sale Branch, 25, Southampton Buildings, Chancery Lane, W.C. at the uniform price of 8d.

NEW PATENTS APPLIED FOR.

When Patents have been communicated the names of the communicators are printed in italics.

553. J. H. Boylan, Manchester. Jan. 11th.—Improvements in, and to, for steam superheaters and steam generators.

556. F. C. Pulsford, London. Jan. 11th. Improvements relating to steam heating apparatus.

567. F. K. R Amesbury, London. Jan 11th. Improvements relating to internal combustion engines.

569. A. Jaubert, London. Jan. 11th Improvements in devices for lubricating wheel hubs and axles, or bosses rotating on spars and the like.

574. A. R Green, London. Jan. 11th.—Improvements in or relating to water gauges for steam boiler or other purposes.

583. C. Ritchie, London. Jan 11th Improvements in and relating to steam and other fluid pressure engines.

594. C. T. Naylor, J. Naylor, and R. Parkinson, Manchester. Jan 12th. Improvements in apparatus applicable as a steam generator or water heater or boiler.

597. J. G. Dunlop and T. Bell, Glasgow. Jan. 12th.—Improvements in and connected with turbines.

613. J. Dodds, London. Jan. 12th.—Improvements in valve gear for motive-power engines.

621. H. Schofield and O. P. Macfarlane, London. Jan. 12th.—Improvements in or relating to boiler furnaces or flues.

627. W. H. Barrett and C. C. Cardell, London. Jan. 12th.—Improvements relating to internal combustion engines.

645. I. Klecan and F. Laske, London. Jan 12th.—Means and method for removing and preventing the formation of scale in boilers.

650. The Honourable C. A. Parsons and C. F. Taylor, London. Jan 12th.—Improvements in tools for boring and grooving turbine cylinders.

653. J. D. Ewen, London. Jan. 12th.—Improvements in ships' propellers.

657. E. Bitzer, London. Jan. 12th.—Improvements in or relating to flexible metallic pipes and tubes.

668. J. Evans, Wolverhampton. Jan. 13th.—Improvements relating to the admission of steam to and its exhaust from steam engine cylinders and to steam cushioning the pistons of such cylinders.

707. T. Drinkwater and G. E. Schofield, London. Jan 13th.—Improvements in the method of and means for facilitating the examination of steam boilers.

733. W. R. Marshall, Oldham. Jan 14th.—An improved appliance for natural or forced draught and prevention of smoke in connection with steam boilers and steam generators.

747. A. S. Goldie, Glasgow. Jan. 14th.—Improvements in and relating to the furnaces of steam boilers and the like.

750. J. G Dunlop and T. Bell, Glasgow. Jan. 14th.—Improvements in or connected with steam turbines.

759. G. Cockburn, London. Jan. 14th.—Improvements in sounding and emergency or like valves for steam-pipe connections.

767. F. B. O. Hawes, London. Jan 14th. Improved means for controlling the output of fans and pumps.

781. Davy Bros., Ltd., and T. E. Holmes, London. Jan 14th.—Improvements in steam hydraulic intensifiers.

791. H. A. Ivatt, London. Jan 14th.—An improved crank shaft for locomotive engines and other purposes.

805. W. Shedden and T. Rowlands, Altrincham. Jan. 16th.—A rotary steam engine and air compressor.

809. D. W. F. Maxwell, London. Jan. 16th.—Improvements in water tube boilers.

810. P. W. Lockwood, and G. and J. Weir, Ltd., Glasgow. Jan. 16th.—Improvements in and relating to couplings and fastenings for steam heating tubes and the like.

813. A. Whitlock, and E. Carr, Preston. Jan 16th.—Improvements in heating apparatus boilers.

831. Circulators, Ltd., and H. Schofield, London. Jan. 16th.—Improvements in or relating to steam boilers.

835. E. L. C. Mollard and G. F. Griffin, London. Jan. 16th. A new or improved apparatus for condensing steam and producing or generating electricity.

852. R. H. Ramsey, London. Jan. 16th.—Improvements in engines.

855. H. B. Boocock and E. H. Boocock, London. Jan 16th. Improvements in steam engines and the like applicable for other suitable purposes.

869. M. H. Voigt, London. Jan. 16th.—Improvements in water-circulation devices for steam generators and the like.

875. A. G. M. Michell, London. Jan. 16th.—Improvements in thrust and like bearings.

878. J. Schmidt, E. Busch and A. Lonborg, London. Jan 16th.—Improvements in or relating to steam engines.

891. H. Orley, Woking. Jan. 17th Improved means for facilitating the propulsion of wheels.

907. J. Hopkinson and J. Hopkinson and Co. Ltd., London. Jan. 17th—Improvements in valves and cocks.

935. The Albany Manufacturing Co., Ltd., and F. Lamplough, London. Jan. 17th.—Mechanism for operating the valves of steam engines and the like.

936. J. B. Bowen, Jun., Coventry. Jan. 17th.—Improvements in or relating to internal combustion engines.

939. J. Holms, Jun., London. Jan. 17th.—Improvements in ends for spreaders of draught chains and the like.

944. F. Anderson and J. S. Jarvis, London. Jan 17th.—Improvements in means for fixing tappets to stamp-stems, applicable also to analogous purposes.

957. The Warwick Machinery Co., Ltd., London. Jan. 17th.—Improvements in stop mechanism for elastic fluid turbines. (*The General Electric Co., U.S.A.*)

958. The Warwick Machinery Co., Ltd., London. Jan. 17th.—Improvements in governing mechanism for elastic fluid turbines. (*The General Electric Company, U.S.A.*)

959. H. H. Frost, London. Jan 17th.—Improvements in or relating to joining of the ends of tubes.

989. A. W. Cooper, Forfarshire. Jan. 18th.—Improvements in turbine engines.

996. C. Russo and G. F. Griffin, London. Jan. 18th.—Improvements in rotary engines.

1,044. P. E. Dowson, Manchester. Jan. 18th.—Improvements in piston rings.

1,092. G. C. Marks, London. Jan 19th.—Improvements in the winding means for the plungers of hydraulic elevators. (*W. F. D. Stokes, U.S.A.*)

1,100. H. S. Walker and D. Horsburgh, Manchester. Jan. 20th. Improvements in steam traps.

1,104. A. Beldam, Liverpool. [illegible] packing.

1,108. S. Fox and Hartley and Sugden, Ltd., Halifax. [illegible] Improvement [illegible]

1,115. R. H. Anderson, Newcastle-on-Tyne. [illegible] Improvements [illegible]

1,135. E. Colinet, London. [illegible] Improvements in [illegible] engines.

1,162. J. W. Mackenzie, London. [illegible] Improvements [illegible] propellers. (*R. H. Shaw.*)

1,185. H. Cruse, Manchester. [illegible]—Improvements in [illegible] between the tubes and drums [illegible] generators.

1,195. J. W. Micklethwait, Gillygate. Jan. 21st.—Railway [illegible] coupler.

1,204. R. Hutchinson, T. H. Sutcliffe, H. Shaw, and M. Broomhead, London. [illegible] Improvements in [illegible] and bearings for [illegible] and the like.

1,210. W. Cassens, London. [illegible] Method of and apparatus for conducting combustion in boiler furnaces.

1,212. W. H. Muddle, Reigate. Jan. 21st.—An adjustable [illegible] of any description.

1,216. O. G. R. Becker, London. Jan. 21st.—Improvements connected with metal shearing machines.

1,225. E. Dalchow, London. Jan. 21st.—Improvements relating to steam turbines. (Date applied for Jan. 22nd, 1904.)

1,228. A. Bulling, London. [illegible] A new or improved [illegible] consuming smoke in [illegible], furnaces, and the like. (Date applied for Jan. 28th, 1904.)

RECENT SPECIFICATIONS.

WATER GAUGES.

J. Hopkinson and Co. Ltd., J. Hopkinson, and R. A. Hopkinson, of Huddersfield. Sept. 21st, 1904.—The invention is directed to new means for attaching the try tap of a water gauge to the water arm so that the try tap can be adjusted to any

Fig 1

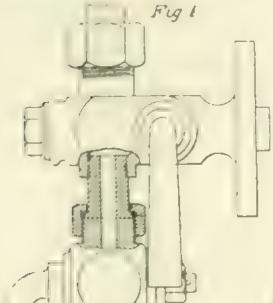
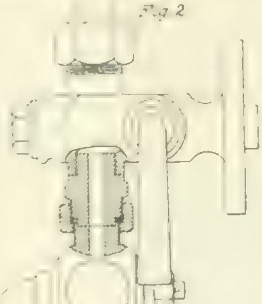


Fig 2



[illegible]

VARIABLE SPEED MECHANISM.

Hulse and Co., Ltd., L.E. Adams, and T. M. Lowthian, of Salford. [illegible]

driven by wheels of the other sets of gear wheels, which latter then act as drivers. When using four wheels in each set as in the example [illegible] a total change of thirty two speeds is obtained, i.e. sixteen changes when the lever is in such a position that the wheel is clutched to the set T of wheels and the shaft is clutched to the set T of wheels which is then the driving set, and transmits motion through the set [illegible] and [illegible] to the set [illegible] of gear wheels, and then through wheels [illegible] and *n* to the shaft [illegible], and sixteen other changes when the lever is in such a position that the wheel *n* is clutched to the set [illegible] of wheels and the shaft is clutched to the set [illegible] which then becomes the driving set and transmits motion through the set [illegible] and [illegible] to the set [illegible] of the gear wheels and thence through the wheels [illegible] and *n* to the shaft [illegible].

LOCOMOTIVE COUPLINGS.

Fried Krupp Akteingesellschaft, of Essen, Germany. Nov. 15th, 1904. (Date claimed under the International Convention Feb. 16, 1904.) This invention relates to self-acting couplings for railway vehicles, the object being to provide a coupling in which release can be effected by a single pull and in which the locking parts of the coupling jaw are mechanically retained in their open or release positions until the jaw has opened, while the parts of the coupling become placed automatically into position ready for again coupling after shunting away the adjacent wagon. The desired ends in view are attained according to the present invention by locking the locking arm (which

Fig 3

Fig 4

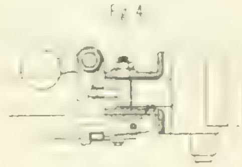
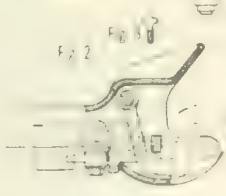


Fig 5



is employed [illegible]

[illegible]

NEW PUBLICATIONS.

"A HANDBOOK OF CHEMICAL ENGINEERING."

Illustrated with working examples, and numerous drawings from actual installations. By George E. Davis. Two volumes, Davis Bros., Manchester.

In order to cope successfully with the various difficulties encountered in the practice of chemical engineering, it is absolutely essential that the engineer should have a sound knowledge of advanced theoretical and applied chemistry. Anyone intending to specialise in this direction cannot do better than secure a copy of the second edition of the above exhaustive work, which is fully illustrated, and bears ample evidence of careful revision; this is particularly noticeable in the matter dealing with stresses on beams and struts, wind pressure, vitriol towers and chambers, the strength of cast-iron columns, the flow of viscous liquids through pipes, etc., while a more amplified account is given of the anemometer. In the second volume, considerable attention is devoted to the separation of minerals by electro-magnetic agency, and the application of heat and cold. The author deals with his subject under the following heads: the technical laboratory, materials used in the construction of plant, power and its application, treating and preparing solids, separating solubles from insolubles, evaporation and distillation, crystalisation and dialysis, applications of electricity, organisation and building.

"LOCOMOTIVE INJECTORS."

A handbook on their theory and application, with hints on repairs and management, and historical notes. By "The Inspector." Locomotive Publishing Company, Ltd. 2s. 6d.

A practical treatise for practical men; the author's aim has been to give lucid explanations of the effects on which the injector depends for its action. The subject is treated without the use of mathematics and therefore should prove more acceptable to locomotive men and stationary boiler attendants. From the same publishers we have received an admirable locomotive chart, designed by J. G. Robinson, M.Inst.C.E., chief mechanical engineer of the Great Central Railway. The various parts of the locomotive are numbered and detailed in the drawing, and on making a reference to the corresponding number in the letterpress, it is easy to arrive at the technical designation of any particular part.

BOOKS RECEIVED.

Engineers Valuing Assistant: being a Practical Treatise on the Valuation of Collieries and other Mines with Rules, Formulæ and Examples, also a Set of Valuation Tables etc. By H. D. Hoskold with an Introductory Note by Peter Gray. Second Edition, Longmans, Green and Co. 7s. 6d. net.

Getting Gold. A Practical Treatise for Prospectors, Miners, and Students. By J. C. F. Johnson, F.G.S. Third Edition. With Fifty Illustrations and Eight Plates. Charles Griffin and Co. Ltd. 3s. 6d.

Fire Tests, with Automatic Sprinklers. Published by the British Fire Prevention Committee.

National Engineering and Trade Lectures, edited by Ben H. Morgan. Volume I., British Progress in Municipal Engineering. By William H. Maxwell, A.M.Inst.C.E. Archibald Constable and Co., Ltd. 6s. net.

Calcareous Cements: their Nature, Manufacture and Uses. By Gilbert R. Redgrave and Charles Spackman. With sixty-three illustrations. Second and Revised edition. Charles Griffin and Co. Ltd.

Mechanism. By S. Dunkerley, M.Sc., etc. With numerous Diagrams. Longmans, Green and Co. 10s. net.

Oil Fuel: its Supply, Composition, and Application. By Sydney H. North. With a Folding Plate and 11 Illustrations. Charles Griffin and Co., Ltd.

CALENDARS AND DIARIES.

Messrs. Robert A. Thompson and Co., Ltd., of 5, Tudor Street, E.C., forward a handy pocket diary.

Messrs. John I. Thornycroft and Co., Ltd., have issued a wall calendar which incidentally calls attention to their motors as used for launches, trade vehicles, motor-cars, etc.

From "The Quarry," the organ of the stone, marble, slate, lime, clay, and cement trades, we have received a wall calendar, the date sheets of which are printed in red and black. It has also a list of H.M. Inspectors of Quarries, etc.

A substantial and handsomely gilt wall calendar has been issued by Deighton's Patent Flue and Tube Company, Ltd. It furnishes monthly date slips for four years, each of them having interesting illustrations of the firm's productions.

We have also received useful calendars from The Parker Foundry Company, of Derby; Princeps and Co., of Sheffield; B. J. Hall and Co., of 39, Victoria Street, S.W., and Birmingham; The Shannon, Ltd., of Ropemaker Street, E.C.; and Nalder Bros. and Thompson, of 34, Queen Street, E.C.

MEETINGS FOR THE ENSUING WEEK.

FRIDAY, FEB. 3.—Royal Society, 9 p.m. Lecture by Professor T. Clifford Allbut.—Geologists' Association: Annual General Meeting, University College, Gower Street, 7.30 p.m.—Junior Institute of Engineers, Westminster Palace Hotel, 8 p.m.: Paper, "Recent Developments in Electric Lighting" by Professor H. T. Davidge.—Institution of Electrical Engineers, Glasgow Local Section, 7.30 p.m.: "The Electric Equipment of Automobiles."

SATURDAY, FEB. 4.—Royal Institution, Albemarle Street, W., 3 p.m.: Lecture, Sir Alexander Mackenzie.—Glasgow Technical College, Scientific Society, 7.30 p.m.: Paper, "Cathode Rays and Allied Phenomena," Professor Blyth.—Institution of Electrical Engineers, Glasgow Local Section: Smoking Concert at Grosvenor Restaurant, Gordon Street, 7.30 p.m.

MONDAY, FEB. 6.—Royal Institution, Albemarle Street, 5 p.m.: General Monthly Meeting—Society of Arts, 8 p.m.: Cantor Lecture, "Reservoir Stylographic and Fountain Pen," Mr. James P. Maginnis.—Institution of Electrical Engineers, Newcastle Local Section, 8 p.m.: Durham College.—North-East Coast Institution of Engineers and Shipbuilders.

TUESDAY, FEB. 7.—Royal Institution, Albemarle Street, 5 p.m.: "The Structure and Life of Animals," Professor Miall.—Institution of Engineers and Shipbuilders in Scotland.

WEDNESDAY, FEB. 8.—Society of Arts, 8 p.m.: "Time Development in Photography and Modern Mechanical Methods of carrying it out," Mr. R. Child Bayley.—Liverpool Engineering Society, 8 p.m.: Paper, "Flow of Water in Pipes, Sewers and Channels," Mr. T. Duncanson.—Mining Institute of Scotland, Bothwell Street, Glasgow, 6 p.m. Paper, "The Application of Electrical Power to Mines in Germany" 4 p.m. visit to Mavor and Coulson works.

THURSDAY, FEB. 9.—Institution of Electrical Engineers, Great George Street, S.W., 8 p.m.: Resumed discussion on Messrs. Booth and Kershaw's paper.—Dublin Local Section, Royal College of Science, Dublin, 8 p.m.—Dundee Institute of Engineers 6 p.m., Paper, "Energy Accumulators," Mr. Andrew Sproul.—Royal Institution, Albemarle Street, W., 5 p.m.

FRIDAY, FEB. 10.—Physical Society: Annual General Meeting.—Royal Society, Albemarle Street, W. 9 p.m.—Royal Astronomical Society, Burlington House, W.: Anniversary Meeting, 5 p.m.

PAGE'S WEEKLY — Miscellaneous

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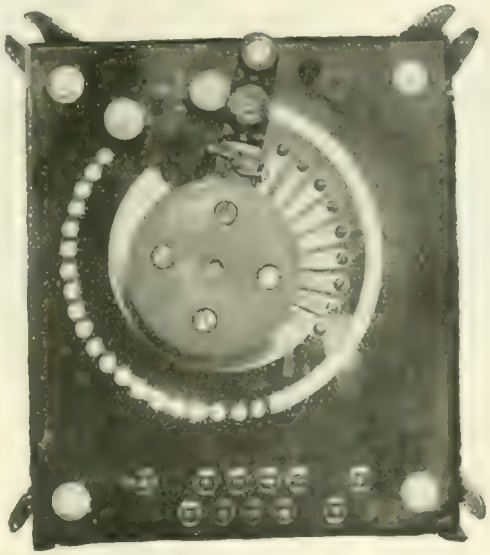

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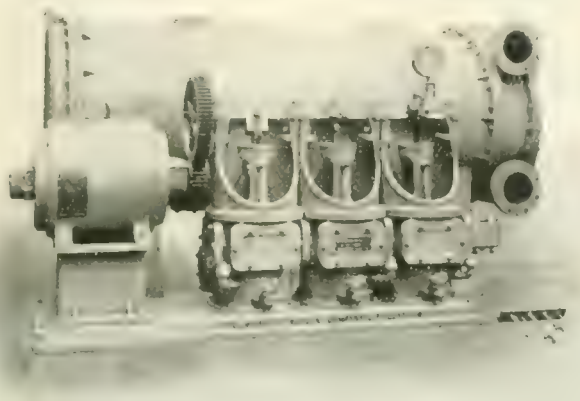

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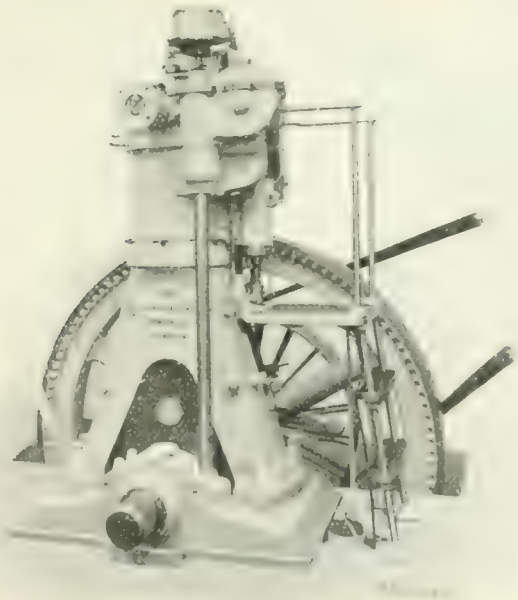

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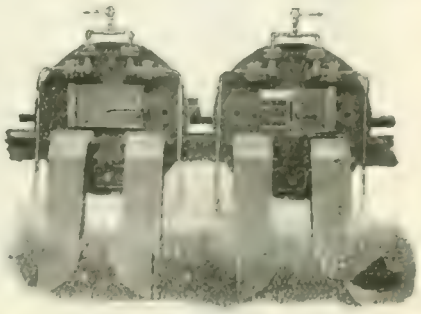

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Miscellaneous

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(1) From the first week in January to the last week in June

(2) From the first week in July to the last week in December, inclusive.

THE INDEX to each volume will be published with the last number of the half-year.

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PAGE'S WEEKLY

Miscellaneous

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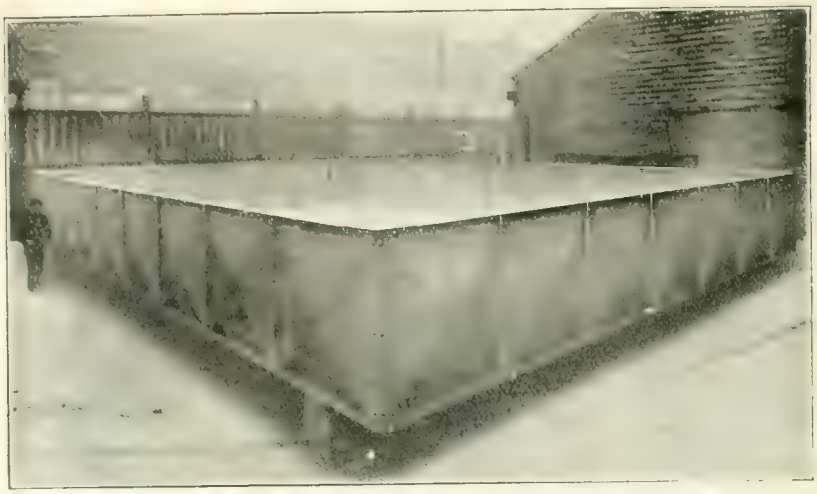

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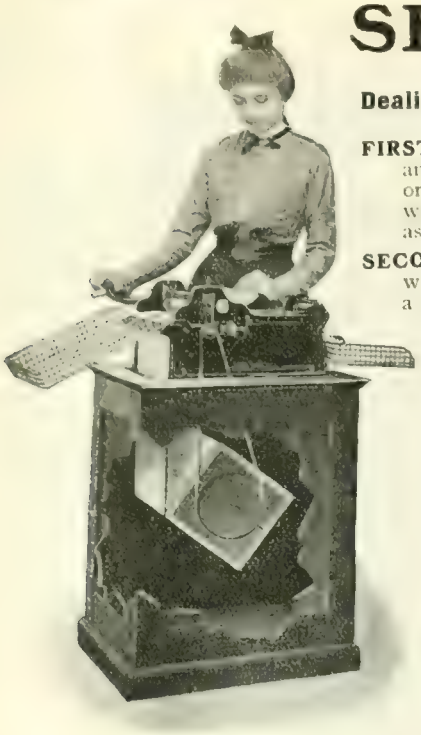
PAGE'S WEEKLY Electrical Apparatus

PAGE'S WEEKLY Systems for Engineers

SHANNON SYSTEMS



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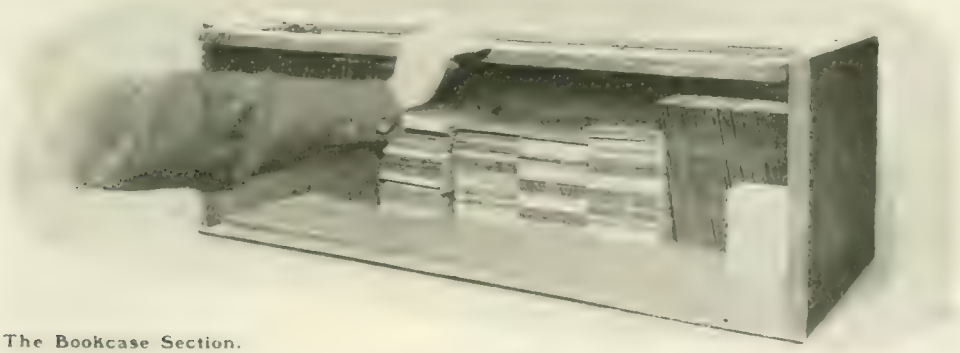

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The "DEY" combines on **THE ONE MACHINE** the good points of all other Automatic Time Recorders on the market.

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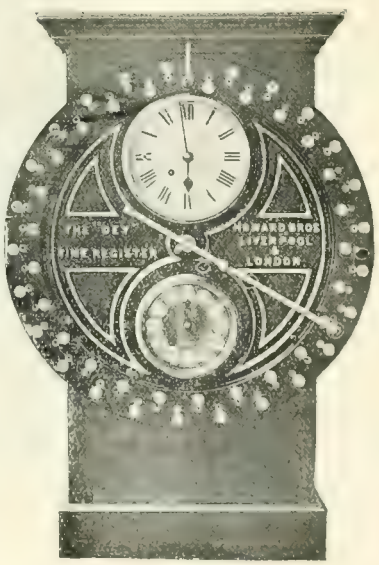

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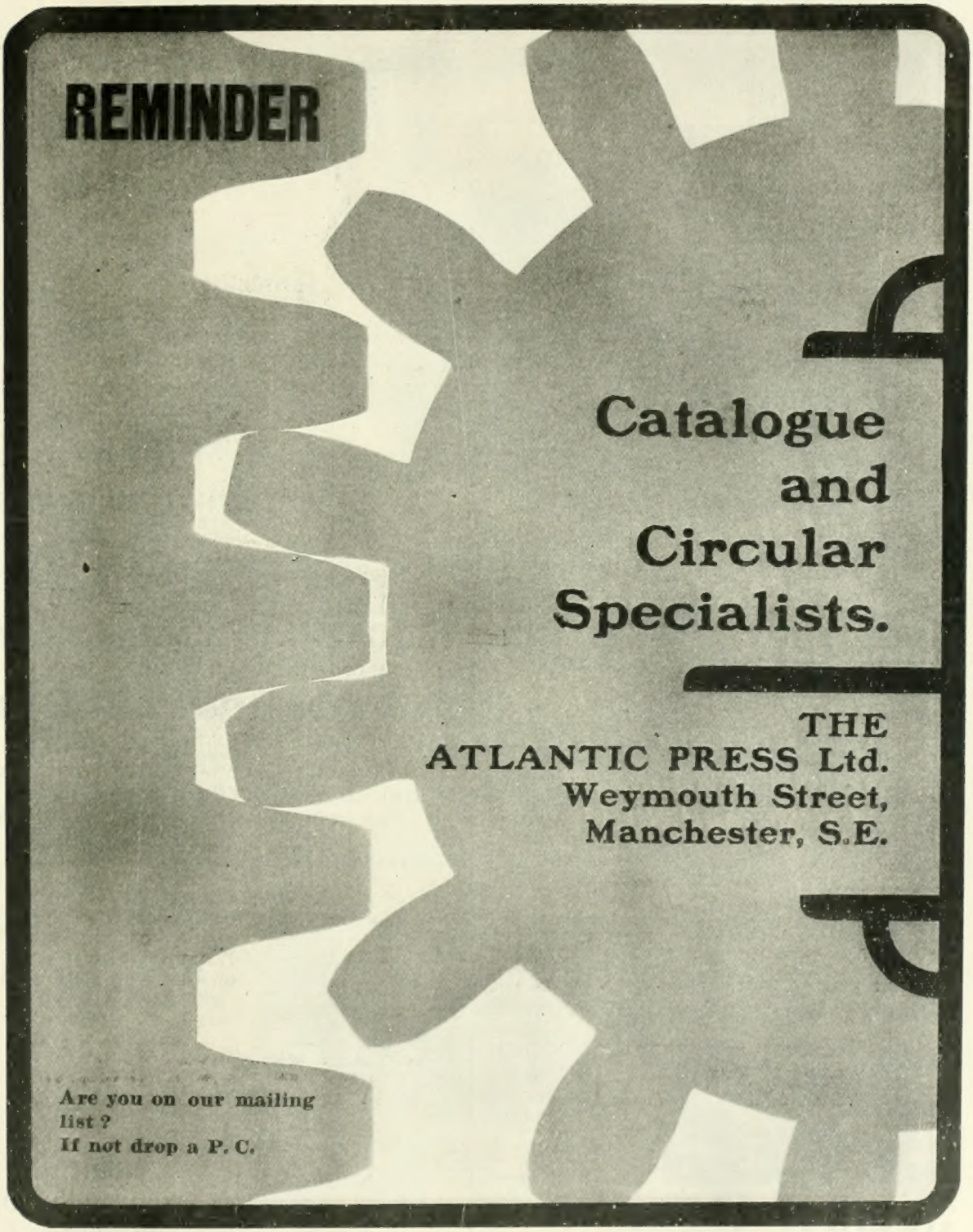
PAGE'S WEEKLY **Printing**

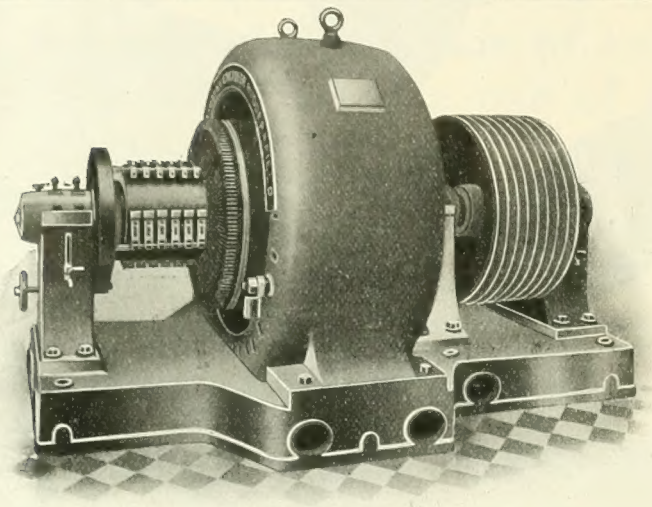


PAGE'S WEEKLY — Miscellaneous

T. W. BROADBENT,

Victoria Electrical Works,

HUDDERSFIELD.



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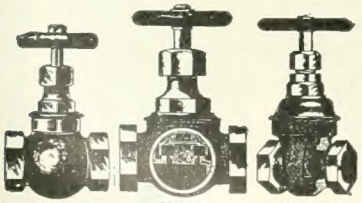

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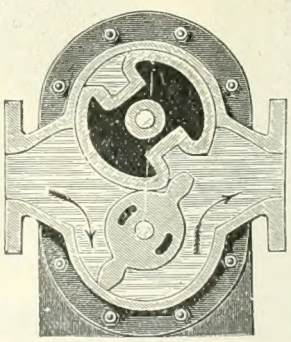

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